MANAGING INJURIES OF THE CENTRAL SLIP: THE HIGHS & LOWS OF CONSERVATIVE TREATMENT

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Introduction

- Anatomy & biomechanics of the central slip
- Rehabilitation considerations
  - Assessment
  - Progression – fracture vs tendinous
  - Complications
- Audit Review
  - Data collection
  - Outcomes
- Next steps and reflections
- References

Background

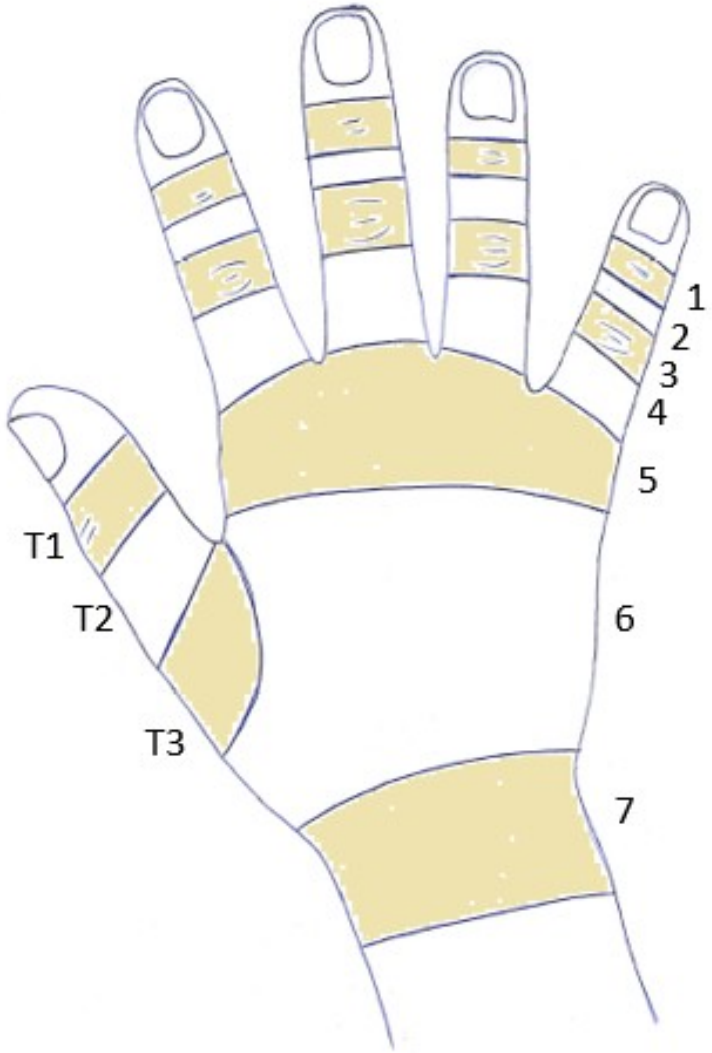
- Previous guidelines within the team were vague and with little information for managing complications.
- 12 patients reviewed retrospectively from 2015-16 – 4 fractures, 8 tendinous.
- Immobilisation period varied from 3 to 9 weeks followed by therapist choice of capener or weaning to night and protection.
- Average TAM = 115.5° (range 50-172°)
- Average PIPJ active flexion = 86.2° (range 56-100°)
- Average PIPJ extension deficit = 15.5° (range 0-64°)

What does the literature say?

Article	**Splint**	**Period of splint**	Outcomes?
Evans 2010	Immobilise PIPJ -> SAM	3/52 then SAM	Average PIPJ ROM 6/92
Kiefhaber 1996	Immobilise PIPJ -> capener	4/52 -> 3/52+	Expert opinion
Chinchalker & Gan 2003	Immobilise PIPJ	Tendinous 6-8/52 Fractures 4-6/52	Expert opinion
Griffin et al 2012	Immobilise PIPJ	4-6/52	Expert opinion
Dy et al 2013	Immobilise PIPJ	4/52	Expert opinion
Lin & Strauch 2014	Immobilise PIPJ -> night splint	6/52 -> 4-6/52	Expert opinion
Grandizio & Klena 2017	Immobilise PIPJ -> night splint	4-6/52 -> 4/52	Expert opinion
Chauhan et al 2014	Immobilise PIPJ -> night splint	4/52 -> 4/52	Expert opinion
Lalonde et al 2015	Relative motion flexion splint	8/52	Expert opinion
Merritt 2014	Relative motion flexion splint	6/52	Expert opinion
Mitz 1989	Dynamic hand based extn splint	6/52	Expert opinion
Brodie & Tan 2014	Stack splint adjusted to PIPJ immob	4-6/52	Expert opinion

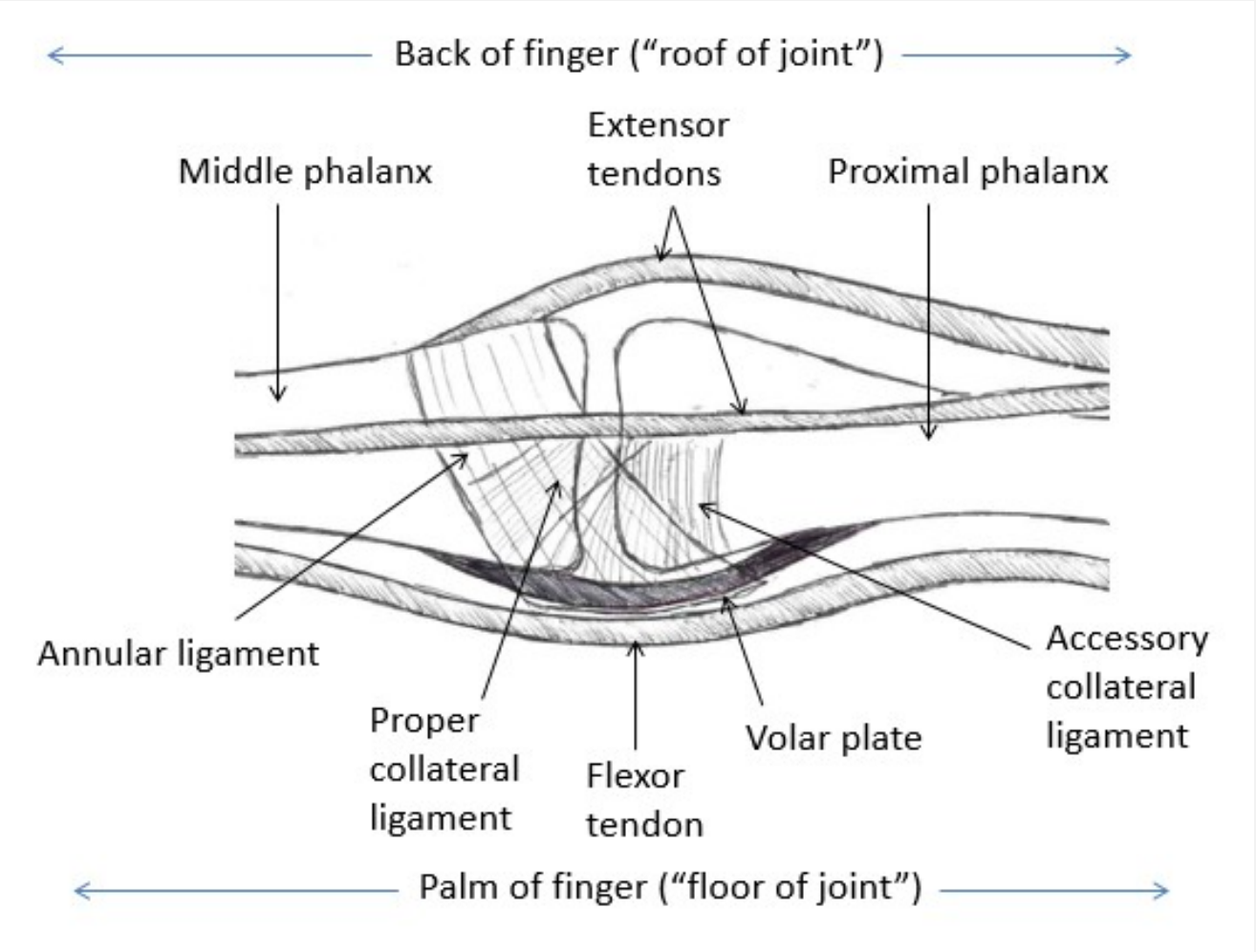
Anatomy – the extensors

- Thin & flat
- High tendon to bone ratio can cause great risk of adhesions after injury
- Zone III = central slip



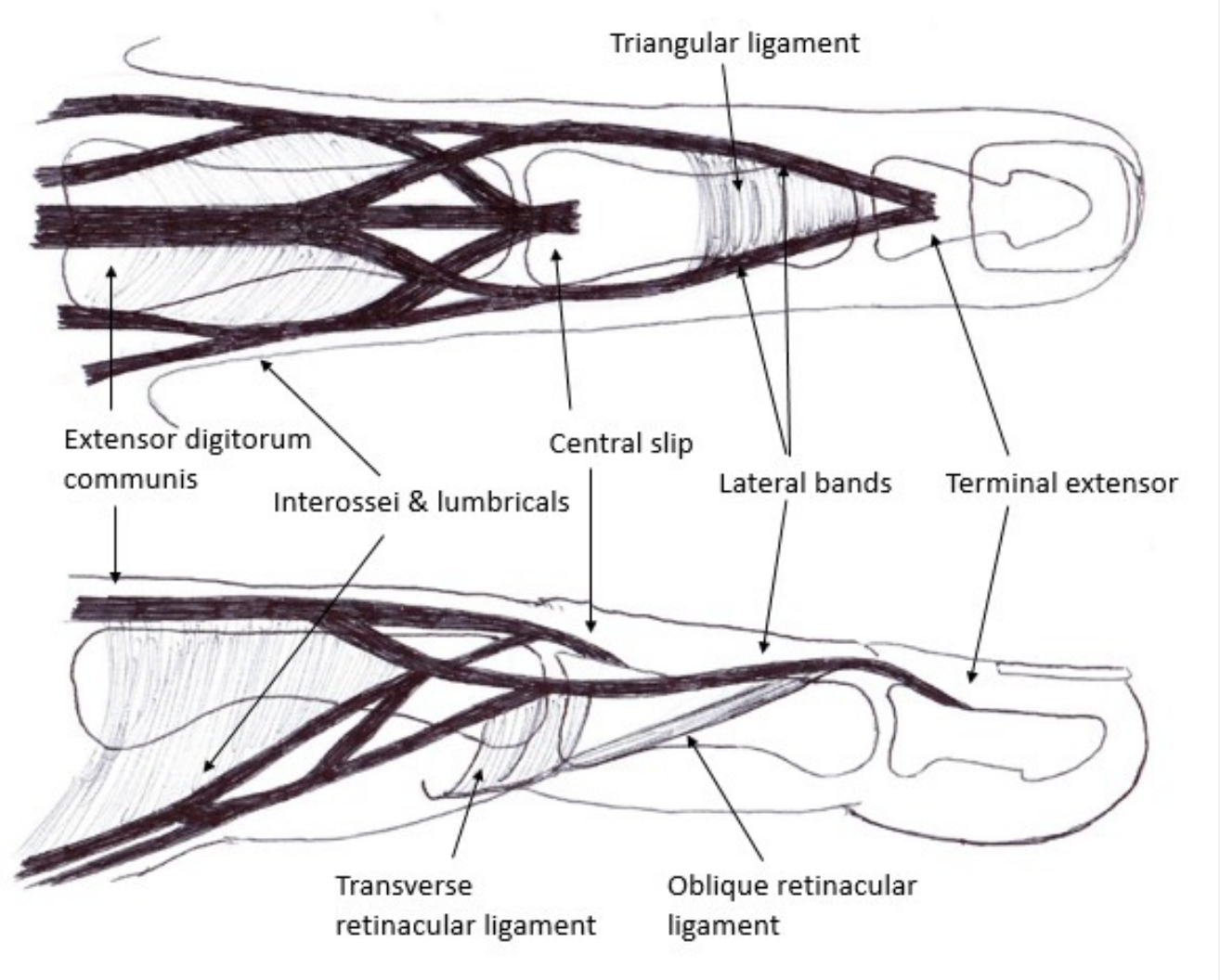
Anatomy – the PIP joint

- Classified as a hinge joint
- Stability is created by an encasing "box" of soft tissue structures.



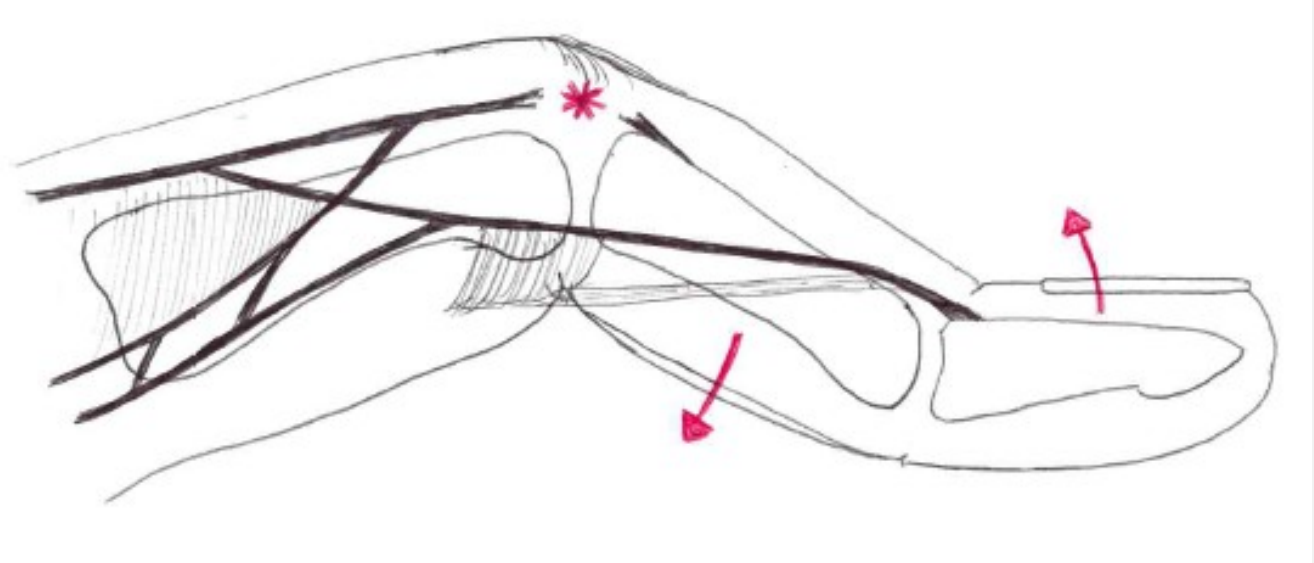
Anatomy – central slip

- Lies superficially to the dorsal PIPJ
- Lumbricals and interossei join CS prior to its insertion on the base of the middle phalanx.



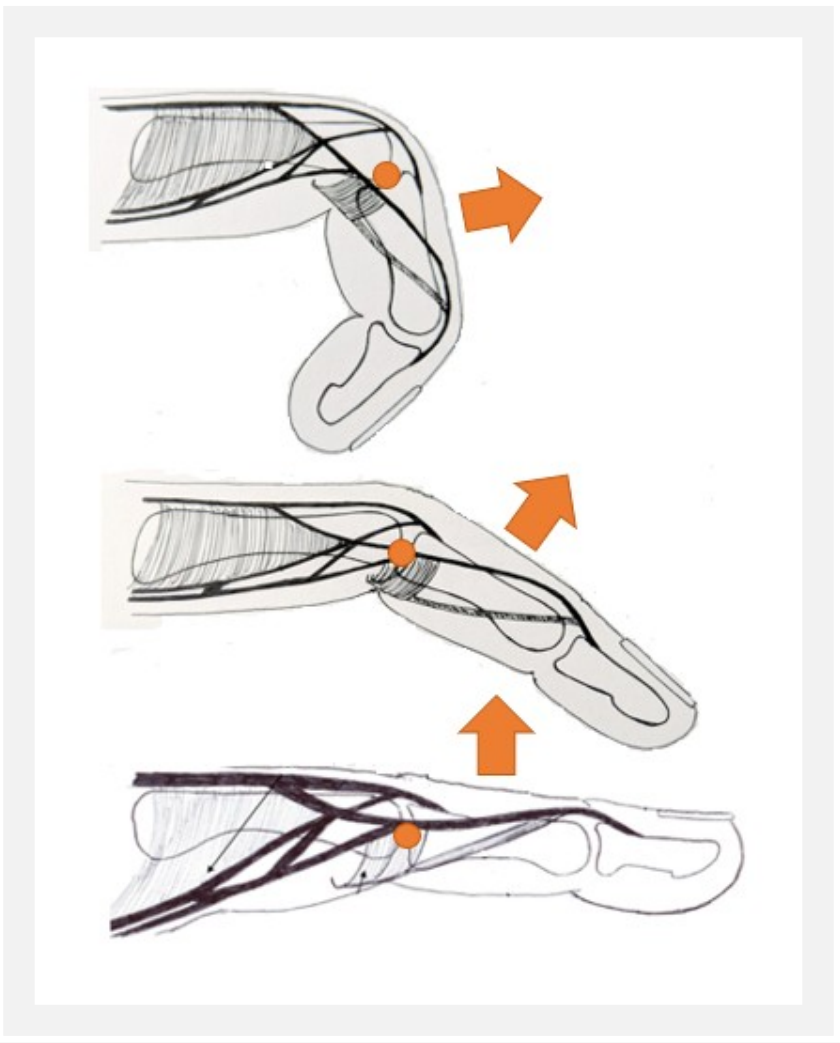
Anatomy – central slip injury

- Central slip ruptures
- Triangular ligament tears away from lateral bands
- Lateral bands migrate volarly (pulling PIPJ into flexion & DIPJ into hyper-extension)
- ORLs and TRLs tighten
- Intrinsics shorten and tighten, causing CS to migrate proximally
- Can result in a Boutonniere deformity in the longer term



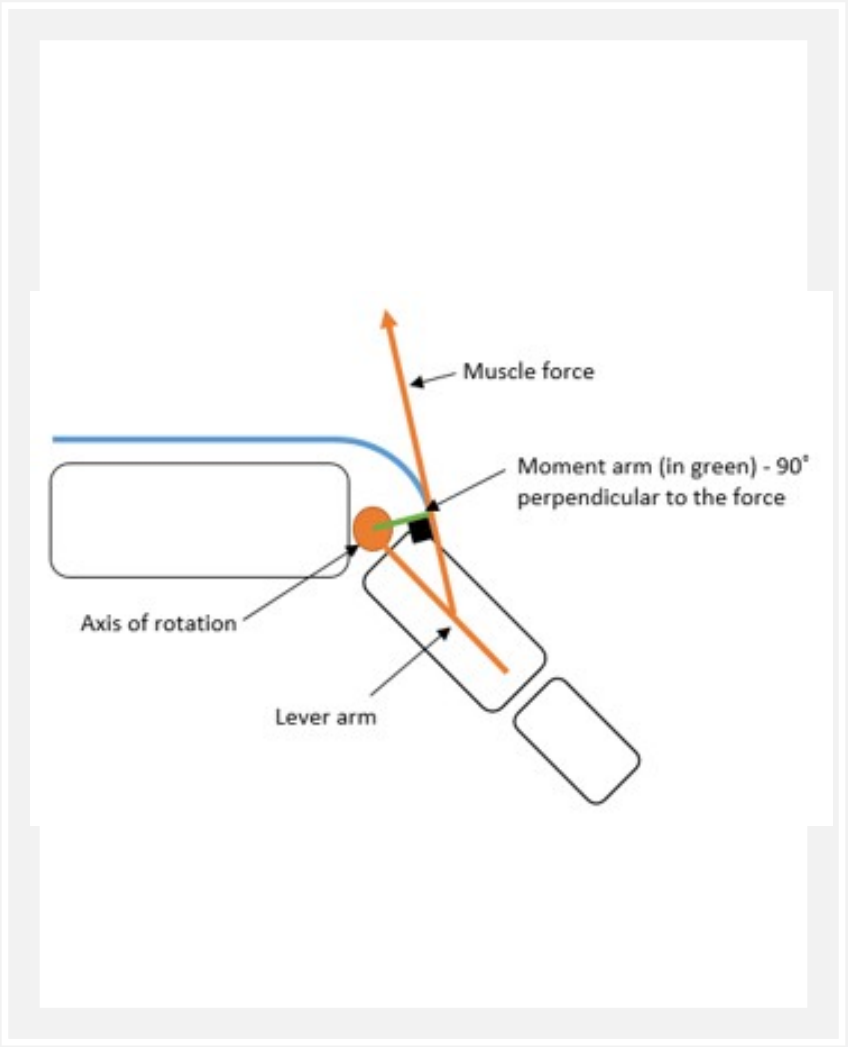
Biomechanics – PIPJ ROM

- Functional arc of movement at the PIPJ reported as 23/87° (Bain et al 1998)
- Flexion to extension
  - CS + intrinsics
  - Lateral bands
- Tenodesis effect:
  - Wrist and MCPJ flexion increases the passive/ resting tension within the extensors, therefore reducing the actual force required of the CS to extend the PIPJ



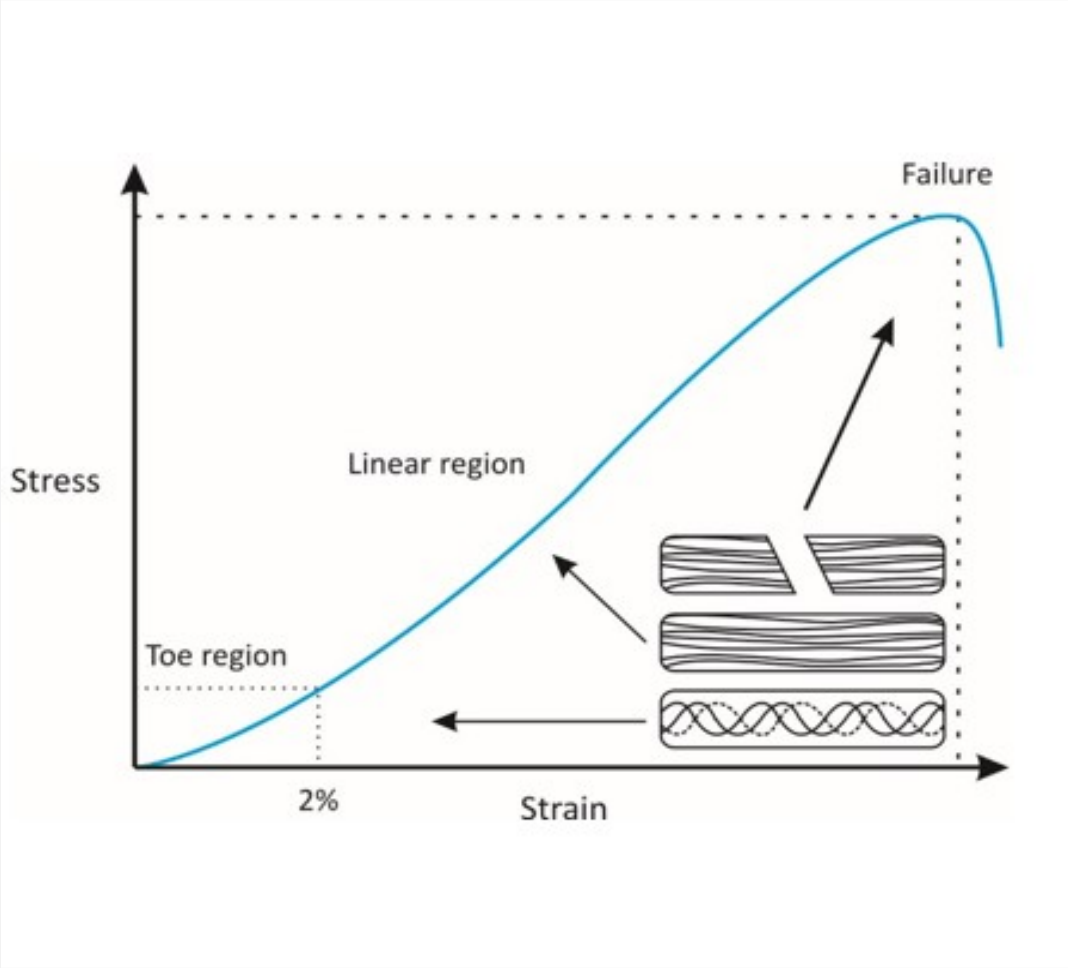
Biomechanics – tendon glide

- What is the ideal amount of tendon glide for the injured CS to prevent adhesions and facilitate healing?
- 3-5mm recommended for flexor tendon repairs
- In vivo - radians/ moment arms
  - 28.65° PIPJ flexion would produce 3.75mm of CS glide (Evans & Thompson 1992)
- Cadaveric studies
  - 37.5-60° PIPJ flexion required for 3mm CS glide (0.5-08mm glide per 10° flexion) (Minamikawa et al 1992, Elliott & McGrouther 1986)



Biomechanics – force/ tension

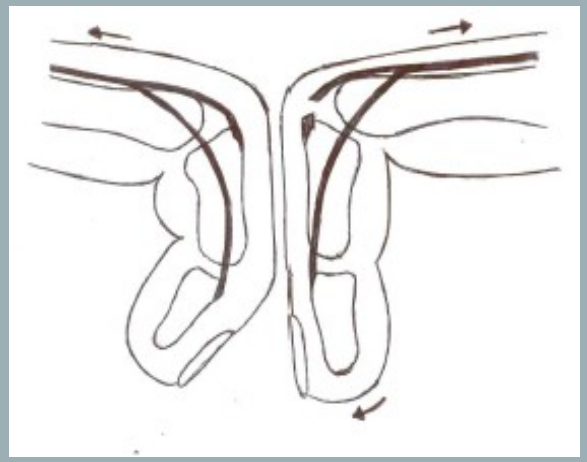
- Stress-strain curve before ultimate tendon failure.
- 45N tolerance in healthy extensor tendons during functional tasks (Fowler & Nicol 2000).
- CS failure tolerance reported as 57.6N (Qian et al 2014).

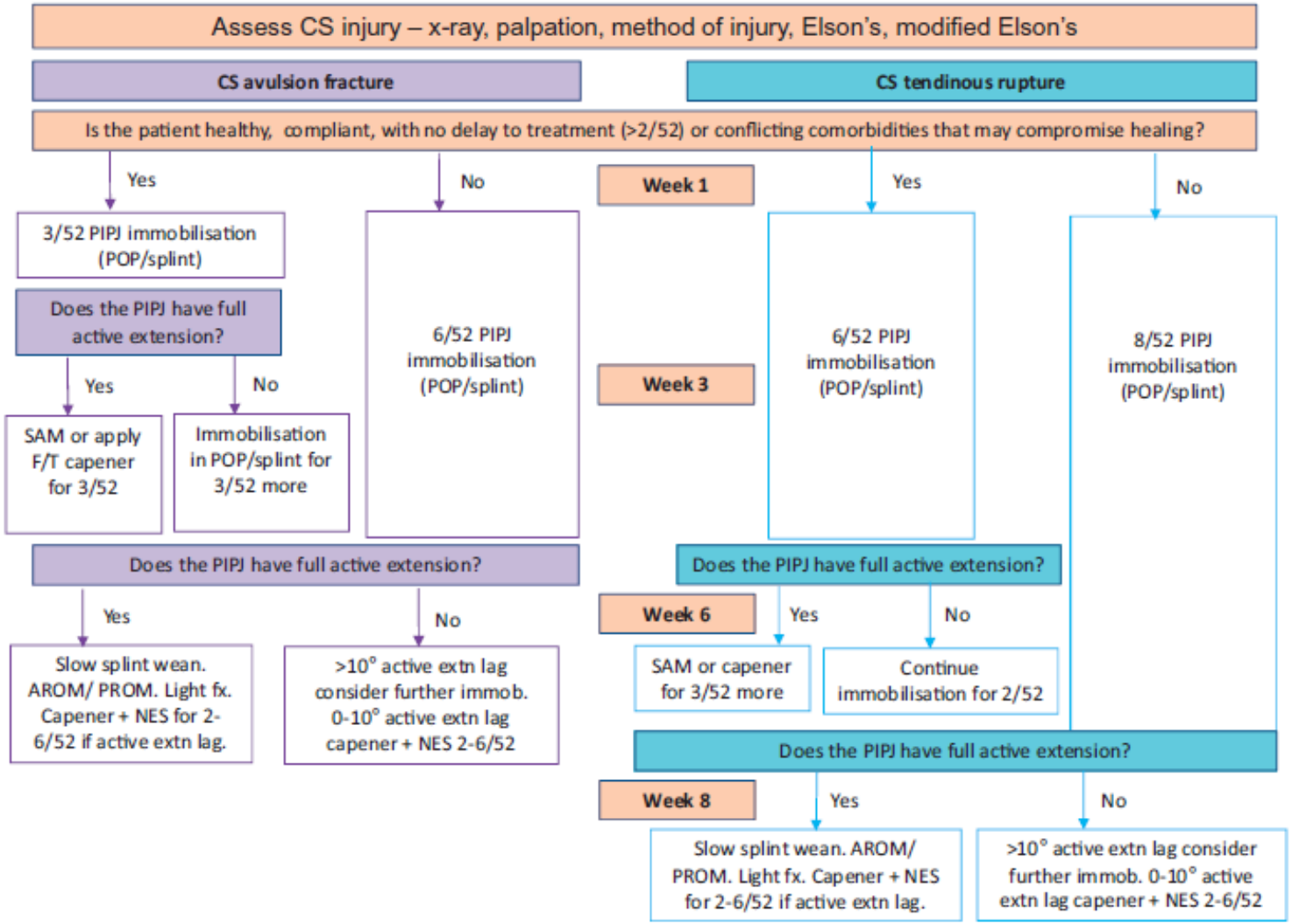


Biomechanics – tendon healing

- Intrinsic and extrinsic healing.
- Prolonged immobilisation can be detrimental to final quality of healing.
- Motion should be commenced as soon as safe to do so, due to the small amount of tendon glide available and high tendon-to-bone ratio.
- Encourages fibroblast movement and collagen production.

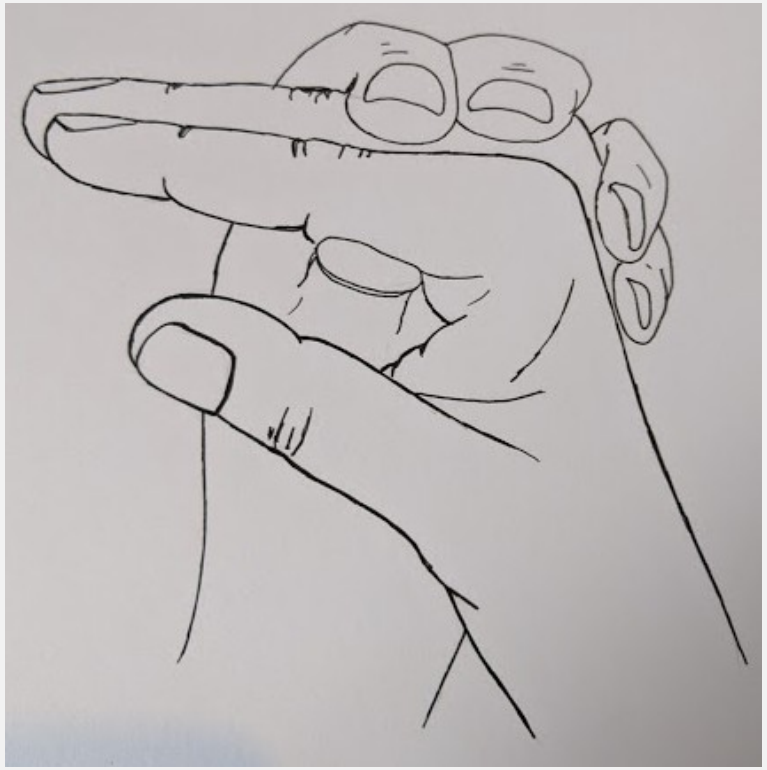
Updated clinical guidelines





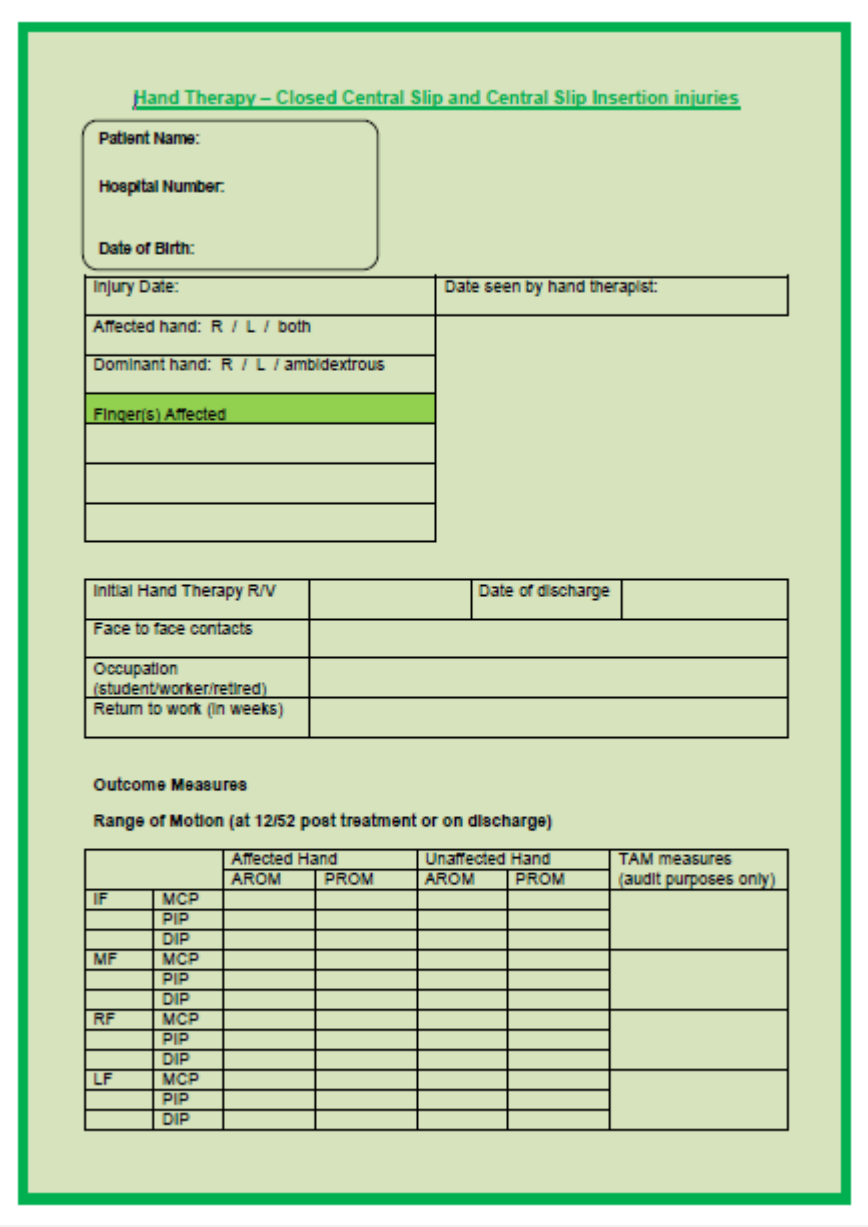
Managing complications

- Extensor lag at PIPJ:
  - Additional period of immobilisation to shorten/ tighten CS if gapping is suspected.
  - Block DIPJ in slight flexion with a zimmer/ splint to increase the tension on the lateral bands causing them to move dorsally (and therefore further assisting PIPJ extension).
  - Use the power of the extrinsic EDC by blocking the MCPJs into flexion (Bouvier's manoeuvre)
- Limited flexion:
  - Massage over the CS insertion and along dorsal P1
  - Gentle passive flexion stretches
  - Resisted exercises



Method of data collection

- Implement new guidelines within the team
- Prospective data collection July 2017- July 2018
  - Inclusion:
    - >16y/o
    - Simple closed CS injury
  - Exclusion:
    - Surgical repair of CS
    - Complex injuries (e.g. concomitant fractures, ligament or tendon injuries, open)
- One drop out from non-attendance after initial appointment.
- **Outcome measures**: ROM & TAM, pain scale, RTW in weeks, injury to referral in days, number of appointments, treatment in weeks, complications.



Hand Therapy – Closed Central Slip and Central Slip Insertion injuries

Patient Name:

Hospital Number:

Date of Birth:

Injury Date:	Date seen by hand therapist:
Affected hand: R / L / both	
Dominant hand: R / L / ambidextrous	
Finger(s) Affected	

Initial Hand Therapy R/V		Date of discharge	
Face to face contacts			
Occupation (student/worker/retired)			
Return to work (in weeks)			

Outcome Measures

Range of Motion (at 12/52 post treatment or on discharge)

		Affected Hand		Unaffected Hand		TAM measures (audit purposes only)
		AROM	PROM	AROM	PROM	
IF	MCP					
	PIP					
	DIP					
MF	MCP					
	PIP					
	DIP					
RF	MCP					
	PIP					
	DIP					
LF	MCP					
	PIP					
	DIP					

Data results

	Retrospective 2015-16 (n=12)	Prospective 2017-18 (n=22)
Injury to HT referral	26.25 days	7.04 days
Number of HT appts	8.6 appt	7.5 appts
HT treatment period	-	13.86 weeks
Pain scale on discharge	-	0.95/10
RTW	2.14 weeks	6 weeks

Data results

	Retrospective 2015-16 (n=12)	Prospective 2017-18 (n=22)
PIPJ extension deficit	15.5°	11.4°
PIPJ flexion	86°	86°
DIPJ flexion	48.7°	56°
TAM	115.5°	139°
Strickland-Glogovac	20% excellent 20% good 50% fair 10% poor	45.5% excellent 27% good 23% fair 0.5% poor

What has happened since?

- Recent literature review:
  - Two new articles
    - One case report: Johnson et al 2019
    - One systematic review of treatments: Geoghagan et al (2019)
- No immediate changes to current guidelines – clarification/refinement of full document with help from our rotational staff relatively new to the hand therapy world.
- Planned to re-audit Feb-July 2020 but then Covid 19 happened!

Reflections

- Fractures have a better outcome than tendinous injuries
- Robust documentation is essential!
  - Use of a data collection proforma
- Additional outcome measures may have provided a broader narrative: Patient rated outcomes eg: qDASH

- Exploration of other treatment options:
  - Relative motion (flexion) splinting (Merrit, 2014)
  - How does this measure up to more 'traditional' treatment options?
    - Really only suitable for the two middle fingers
    - Duration of splint wear unknown
    - Functional requirements
- Do outcomes differ if a POP is used instead of a thermoplastic splint?

“Recipes tell you nothing.
Learning techniques is the key.”
— Tom Colicchio

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