

“Theta Sign” Indicating Lumbrical Origin Strain of Ring Finger Flexor Tendons in Rock Climbers

- a Case Series with Imaging Findings

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Background

- ▶ We report 5 cases of forced flexion injury resulting in a unique imaging finding of fluid surrounding the ring finger flexor tendons at the palmar level.
- ▶ In all cases there was circumferential fluid around **flexor digitorum profundus** (FDP) and **flexor digitorum superficialis** (FDS) demonstrated on MRI and/or ultrasound at the distal palmar level at the “bare area” which normally is devoid of a synovial sheath.
- ▶ On imaging, this peritendinous fluid resembled the Greek letter theta. Therefore, we have referred to this as the “theta sign”.
- ▶ We have theorised that the injury involves a tear of the lumbrical origin fibres at the FDP tendon and at lumbrical attachments to the adjacent FDS tendon.
- ▶ There is a paucity of information in the literature regarding this injury and its specific imaging findings, particularly MRI features. Lack of awareness of this injury renders accurate diagnosis difficult.

Anatomy of the Hand

- ▶ The lumbricals, intrinsic muscles of the hand, originate from FDP in a “bare area” (Fig. 1) between the synovial flexor sheaths of the fingers and the common flexor sheath of the palm (ulnar bursa).
- ▶ The third and fourth lumbricals are bipennate while the first and second are unipennate.
- ▶ Bipennate muscles (double feather-like) have increased strength at the expense of reduced range of motion and ability to stretch.



Fig 1. The extra-synovial **bare area** (arrow). Note the bipennate third and fourth lumbricals and unipennate first and second lumbricals.

Imaging Findings

Cases 1-3

- ▶ Cases 1-3 are all male rock climbers who described a sudden “popping” sensation in the palm in line with the fourth metacarpal with sudden pain while pulling particularly hard during rock climbing.
- ▶ All three patients were using their entire hand at the time of the injury, rather than having their ring finger in a one-finger-pocket.
- ▶ All three patients described marked pain on resisted flexion of the ring finger. None had local tenderness, swelling or bruising.
- ▶ The finding of fluid around the FDS and FDP ring finger tendons in the distal palm was demonstrated in all 3 cases.

Figs. 2 & 3 - **Case 1**. A 49-year-old rock climber with the above-described hand injury. Theta sign (arrow) demonstrated on MRI and ultrasound of his right hand.

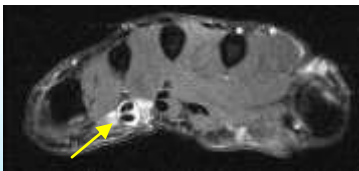
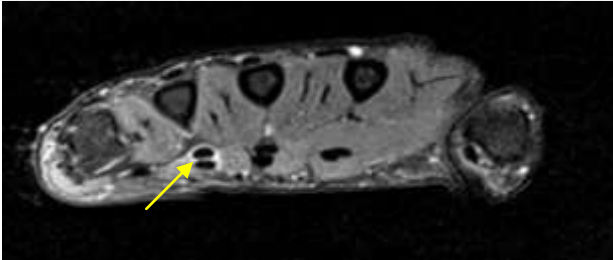
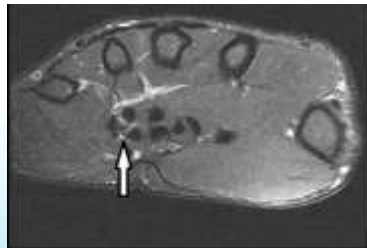
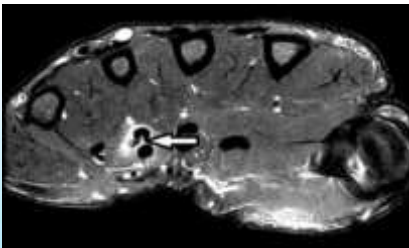


Fig. 4 - **Case 2.** A 22-year-old male rock climber who developed the same symptoms as the patient in Case 1 during rock climbing. MRI of his left hand demonstrates the theta sign (arrow) of peritendinous fluid around FDS and FDP.

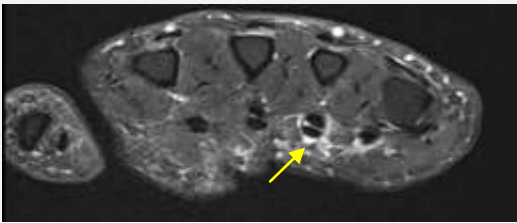


Figs. 5 & 6 - **Case 3.** A 25-year-old man developed the aforementioned symptoms during rock climbing. MRI of the left hand demonstrates peritendinous fluid around ring finger FDS and FDP tendons in the bare area. An intrasubstance tear of a lumbrical origin from FDP is present (arrow, Fig. 5). In addition, lumbrical fibres originating from the FDS tendon are seen (arrow, Fig. 6).

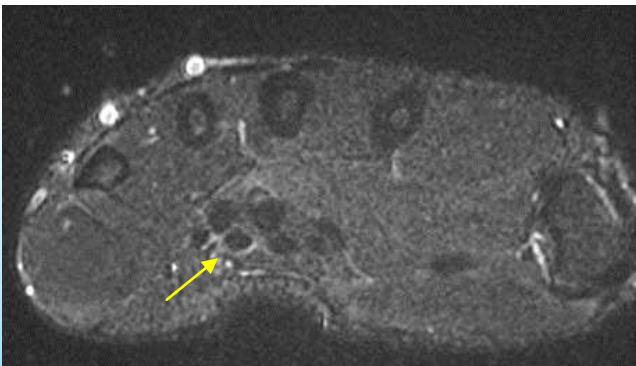


Cases 4-5

- ▶ Fig. 7 - **Case 4.** A 52-year-old man developed a forced flexion injury while attempting to restrain an operating jackhammer. While doing so, he developed sudden sharp pain in the ring finger radiating up his right hand. MRI demonstrates fluid around the FDS and FDP tendons (arrow) in the bare area at the distal palm of the right hand.



- Fig. 8 – **Case 5.** A 41-year-old man suffered a forced flexion injury attempting to save himself from slipping off a ladder by grasping for the rung. MRI demonstrates fluid around the FDS tendon (arrow) in the distal palm of the left hand in the bare area.



Conclusion

- All five of our patients suffered a forced flexion injury of the hand resulting in a specific imaging finding which we have referred to as the “theta sign”.
- We postulate that the predilection for the ring finger flexor tendon lumbricals origin attachments could relate to the reduced range of motion and increased force generated by the bipennate third and fourth lumbricals predisposing them to strain from overstretching.
- The finding of peritendinous fluid around FDS and FDP in the distal palm associated with lumbricals origin strains suggests that lumbrical origin attachments occur at both FDS and FDP tendons at the bare area, despite conventional anatomy teaching that the lumbricals usually originate only from FDP. Note in **Case 3** lumbrical fibres were seen to arise from FDS (Fig. 6) and from FDP which supports this theory.
- Further research on the anatomy of the lumbricals and its likely attachment to the FDS tendon is recommended.

References

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