To define the exact site of triggering in trigger fingers

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Introduction

Trigger finger is a symptom of inflammation of the tendons and synovium in the finger, and commonly presents as triggering or "locking" of the finger during finger flexion.[1]

Literature reports the presence of thickened A1 pulleys (akin to tunnels that tendons run through) with "fibrcartilaginous metaplasia" in trigger fingers.[2] But little is known about tendon involvement and the concept of a tendon "nodule".

To improve treatment options for patients, we need a better understanding of the exact anatomical pathology in trigger finger.

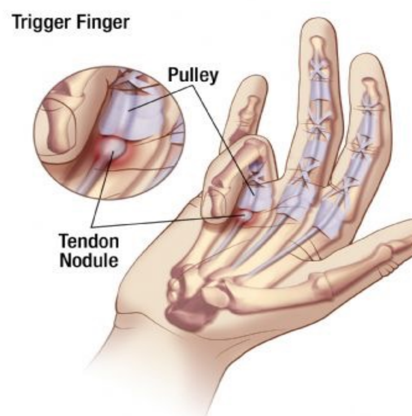

Figure 1. The concept of a nodule present in the finger that gets caught under the A1 pulley, and may cause "triggering" or "locking" on finger extension.[3]

Aims:

- In various postures of finger joint flexion, to show that trigger fingers have a larger tendon thickening that moves proximally during finger flexion, by using static measurements of tendon diameter and cross sectional area, and A1 pulley at specified fixed positions.
- To use a dynamic study to reflect that trigger fingers have more sites of adhesions in tendon margins and loss of differential movement between tendons.

Materials and Methods

20 trigger fingers and 20 normal controls from the contralateral hand were examined using high-resolution ultrasound.

Static study: measurements done in all three finger postures, and in five finger positions (Figure 2A-C and Table 1 respectively)

- Flexor tendon diameters and A1 pulley thickness (Figure 3A)
- Flexor tendon cross-sectional area (Figure 3B)

(Cross-sectional area of flexor tendons = π x anteroposterior dimension x transverse dimension)

Table 1: Finger positions determined by anatomical bony landmarks

Finger position	Measurements done at finger positions:
1	Vertically above maximum curvature of metacarpal head
2	Above proximal edge of proximal phalanx
3	1/8 entire length of proximal length
4	1/4 entire length of proximal length
5	1/2 entire length of proximal length

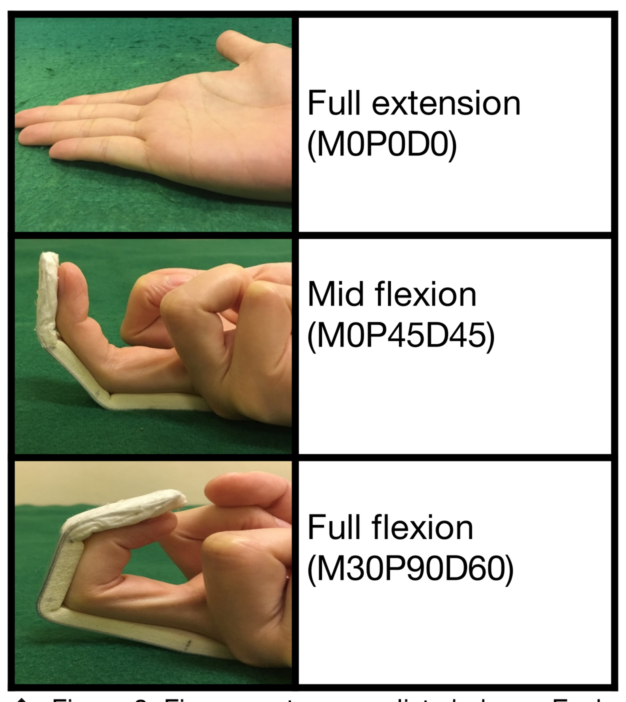

Figure 2. Finger postures are listed above. Each finger posture had specified finger flexion angles at the metacarpal phalangeal joint (M), proximal interphalangeal joint (P) and distal interphalangeal joint (D).

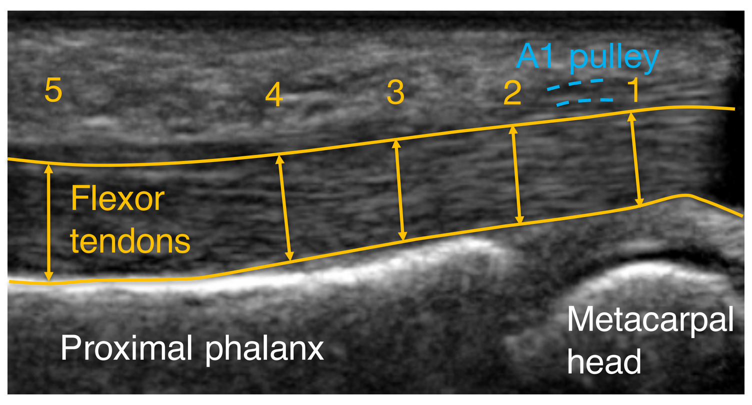

Figure 3A. Sagittal view of flexor tendons. The tendon diameter were measured at the 5 different labelled anatomical positions, in the plane parallel to the tendon.

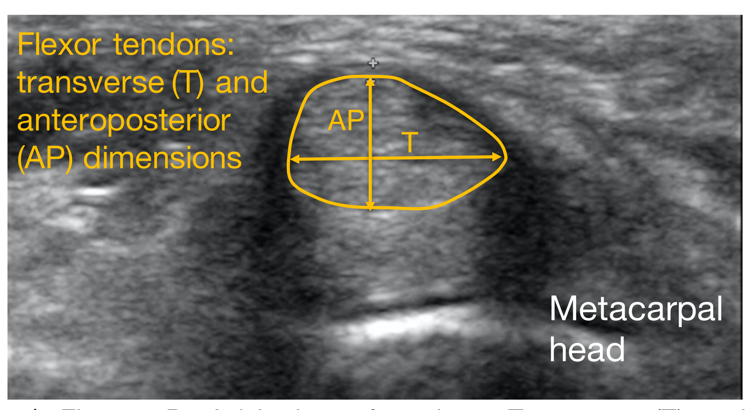

Figure 3B. Axial view of tendons. Transverse (T) and anteroposterior (AP) dimensions of tendons are used to calculate cross-sectional area of tendons.

Dynamic study: done only in full extension as starting position (Figure 4)

- Presence of adhesions superficial or deep to tendons
- Presence of differential movement between tendons

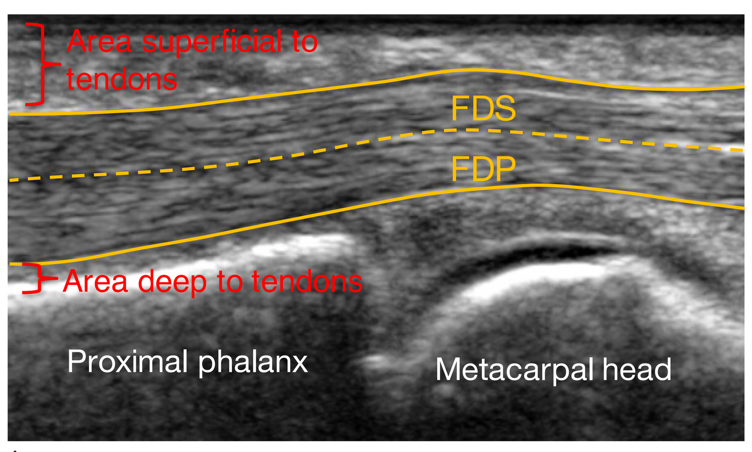

Figure 4. Dynamic study of flexor tendons. The dotted line separates the two flexor tendons, flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP). The presence of differential movement is defined as only the FDP (deep tendon) moving during DIPJ flexion, with the FDS (superficial tendon) remaining stationary.

Acknowledgement

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Literature

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Results

1. Trigger fingers have generalised thickening of the flexor tendons.

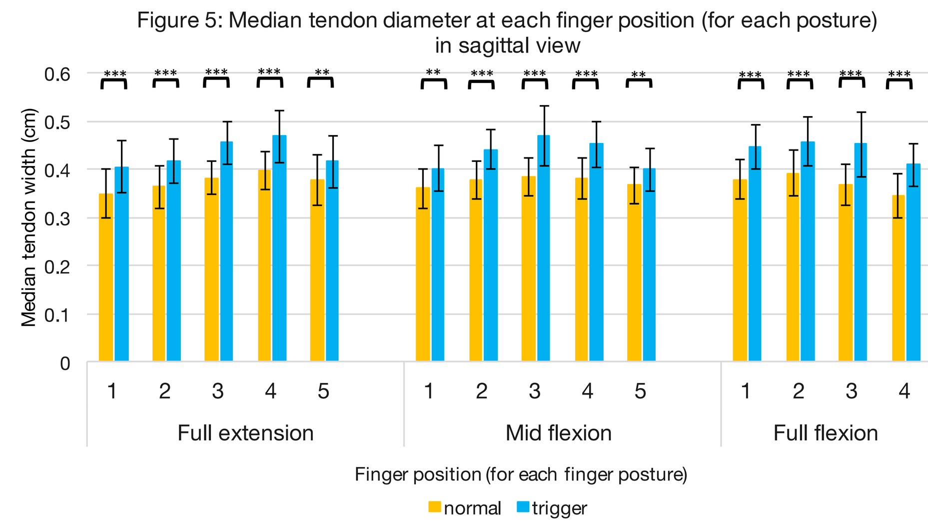

Figure 5. A paired Wilcoxon test compared median flexor tendon diameters between normal and trigger fingers. Flexor tendon diameters in trigger fingers are significantly thicker than those in normal fingers, at all finger positions, and in every finger posture.
(* = p > 0.05, ** = p < 0.01, *** = p < 0.001)

2. There is an anatomical thickening at position 4 (1/4 the length of the proximal phalanx) in full extension in both normal and trigger fingers.

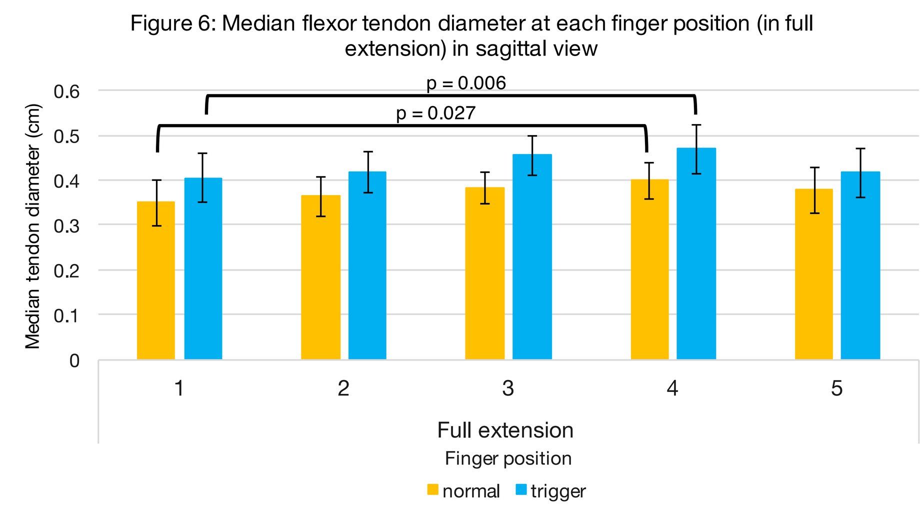

Figure 6. A one-way ANOVA test compared median flexor tendon diameters in Position 1 and Position 4 in full extension. There is a significant difference between the median tendon diameter in position 1 and position 4 in full finger extension, in both normal and trigger fingers.

3. Upon finger flexion, the anatomical thickening moves proximally from position 4 (in full extension) to position 3 (in mid flexion) to position 2 (in full flexion).

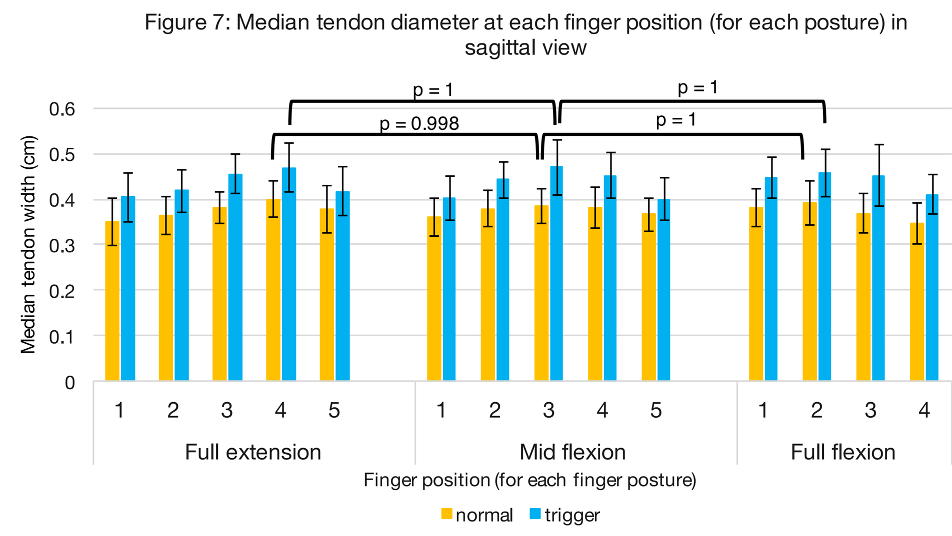

Figure 7. One-way ANOVA tests compared median flexor tendon diameters in:

1. Position 4 (in full extension) to position 3 (in mid flexion)
2. Position 3 (in mid flexion) to position 2 (in full flexion)

The lack of statistical significance between the above positions indicate the proximal movement of the same nodule upon finger flexion.

4. There is a step-wise increase in median flexor tendon cross-sectional area at position 1 during finger flexion (full extension to mid flexion to full flexion) in normal and trigger fingers.

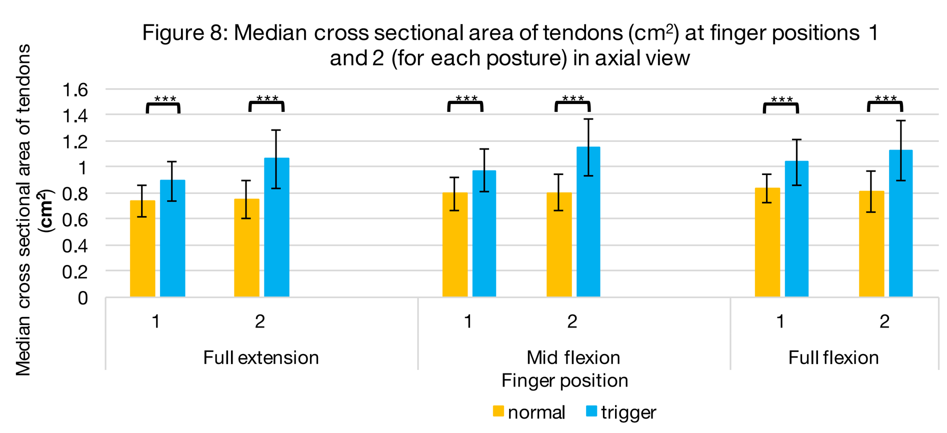

Figure 8. A paired Wilcoxon test compared the median cross-sectional area of flexor tendons between normal and trigger fingers. In axial view, the cross-sectional tendon area of trigger fingers was significantly thicker than that of normal fingers, in all finger positions, at every finger posture.
(* = p > 0.05, ** = p < 0.01, *** = p < 0.001)

5. The significantly thickened A1 pulleys and larger tendon thickening in trigger fingers may explain the symptoms that patients experience.
(The ratio of median flexor tendon diameters in position 4: position 1 (in full extension) was 1.13:1 and 1.17:1 in normal and trigger fingers respectively)

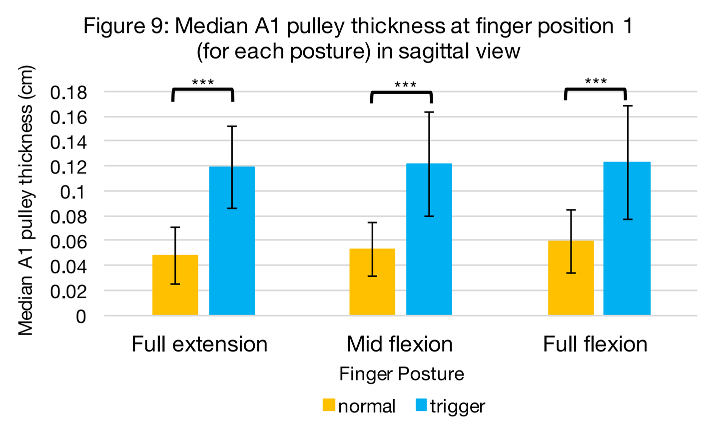

Figure 9. A paired Wilcoxon test compared the median A1 pulley thickness of normal and trigger fingers. Trigger fingers have significantly larger A1 pulley thickness at position 1, in every finger posture.
(* = 0.05 > p > 0.01, ** = p < 0.001)

6. The number of sites of adhesions could be used to assess and grade the severity of adhesions in trigger fingers.

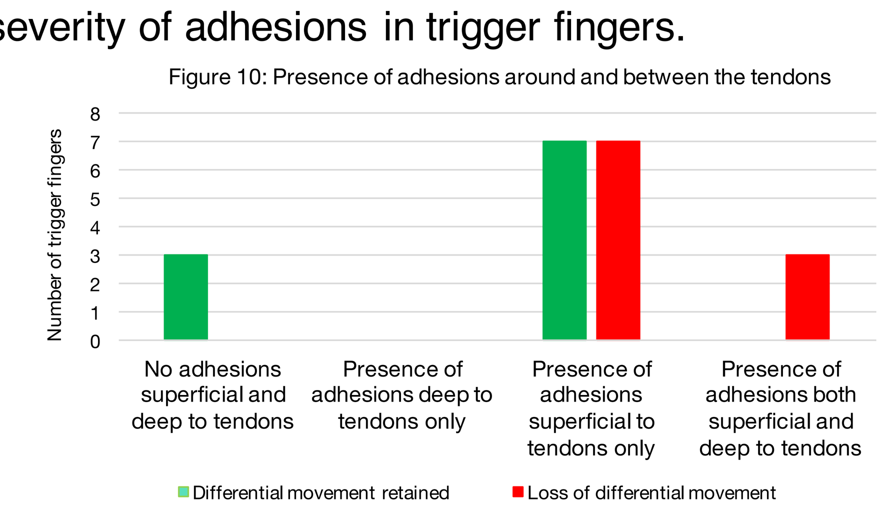

Figure 10. Patients with adhesions around the flexor tendons were also more likely to lose differential tendon movement (due to adhesions between the tendons). Conversely, those without adhesions around the tendons, were also unlikely to suffer from adhesions between tendons.

Conclusions

- It has been previously hypothesised that an enlarged tendon nodule that moves proximally on finger flexion causes trigger finger.[4] Our study confirms this hypothesis.
- Trigger fingers have collagenous degeneration in tendons that may be contributed by tendon stem cell senescence.[5, 6]
- Severity of adhesions has potential value in determining the treatment choices for trigger finger patients.