

# World record in reliability?

## Reliability study on measuring thickness of Achilles tendon with ultrasound

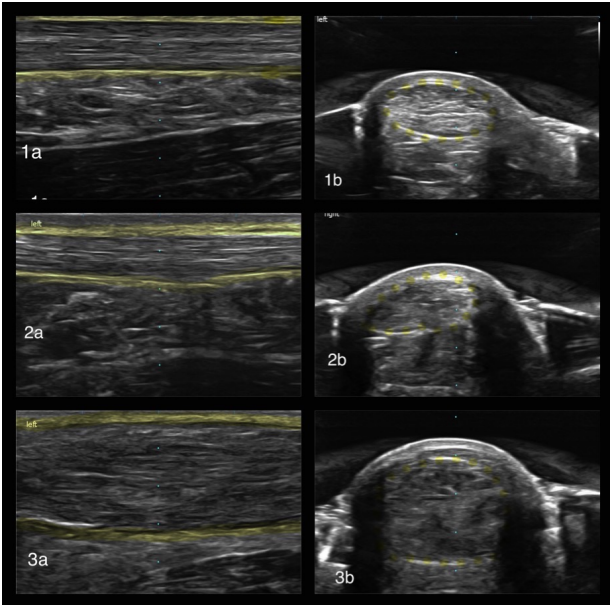


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### Introduction

Symptoms in the Achilles tendon are often accompanied by changes in its structure (see Figure 1). This study focused on examining the reliability of using a structured ultrasound procedure in measuring Achilles tendons with a history of symptoms. Previous studies show ICC reliability ranging from 0,60-0,95 but greater accuracy is needed in ultrasound scanning (Johannsen et. al, 2016).



**Figure 1:** **1a** longitudinal image of a healthy Achilles tendon; **1b** image in transverse view of the same Achilles tendon. **2a** longitudinal image of a thickened Achilles tendon with a history of tendinopathy; **2b** the same Achilles tendon in transverse view. **3a** longitudinal image of an Achilles tendon with a history of Achilles tendon rupture; **3b** same Achilles tendon in transverse view.

### Materials and methods

Measurements were taken by three novice examiners who got various amounts of training sessions in ultrasonography. Participants with history of pain, tendinopathy and/or rupture in the Achilles tendon were recruited via social media. Examiners 1,2 and 3 got four, seven or ten training sessions consecutively. Standardized procedures were used to locate the thickest part of the tendon (see Figure 2).

Each participant was measured twice by each examiner on non-consecutive days. The reliability coefficient used in this study was ICC 1,k for intra-rater reliability and 95% CI was calculated.



**Figure 2:** **2a** Patient lies prone on a plinth and thickest part of the tendon is located in longitudinal view; **2b** A gel pad is placed over the thickest part of the tendon and the probe is moved down the tendon to locate region with greatest CSA. When the thickest part is located, the probe is rotated to ensure smallest width (pink arrows). Then the probe is tilted forward and backwards to ensure greatest brightness (green arrows). Then an image is taken and the 2b process repeated 10 times.

### Results

| Intra-rater reliability ICC(1,k) |       |                        |                         |                         |
|----------------------------------|-------|------------------------|-------------------------|-------------------------|
|                                  | ICC   | P-value                | Lower confidence limits | Upper confidence limits |
| Examiner 1                       | 0.998 | 3.12x10 <sup>-12</sup> | 0.994                   | 0.999                   |
| Examiner 2                       | 0.980 | 3.59x10 <sup>-7</sup>  | 0.941                   | 0.994                   |
| Examiner 3                       | 0.991 | 7.91x10 <sup>-9</sup>  | 0.973                   | 0.997                   |

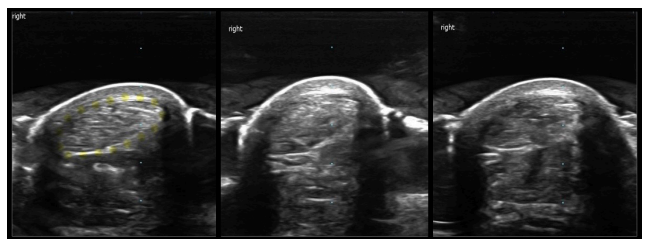
**Table 1:** Reliability of examiners 1,2 and 3

Nine participants were recruited. Calculations on intra-rater reliability of the three examiners between first and second measurements ranges from 0.980-0.998 (see Table 1).

### Discussion

According to Koo and Li (2016) the intra-rater reliability of this investigation is considered excellent. There are few studies that focus on measuring thickness in participants with history of pain or pathology. In comparison a similar investigation was conducted that examined the reliability of two experienced examiners. (Johannsen et al., 2016; Kälebo et al., 1992). Similar to our study, participants with a history of heel pain had two scans performed by each examiner. Their data shows intra-rater reliability of ICC 0,90 for examiner 1 and ICC 0,78 for examiner 2 which is even lower than the lower-bounds of the CI reported in the current study (Johannsen et al., 2016). In conclusion, when a structured ultrasound examination procedure is used, even novice examiners with minimal practice can achieve world-class reliability.

Down below you can see images taken by the three examiners of the same tendon (see image 3).



**Image 3:** Thickness images in transverse view of the same Achilles tendon taken by the three examiners.

### References

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