

Characterizing tendon integrity using quantitative ultrasound imaging in individuals with unilateral **Achilles tendinopathy:** Are all outcome measures equally relevant?

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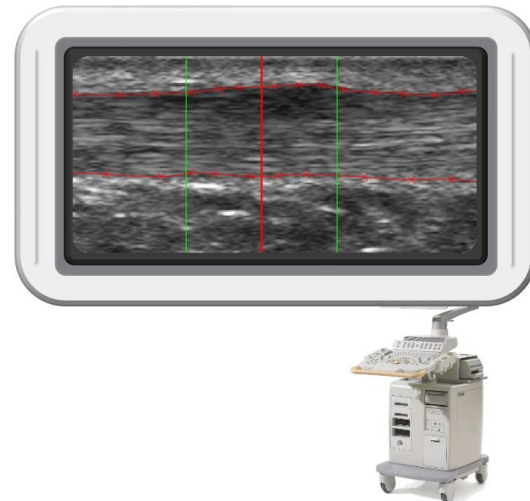
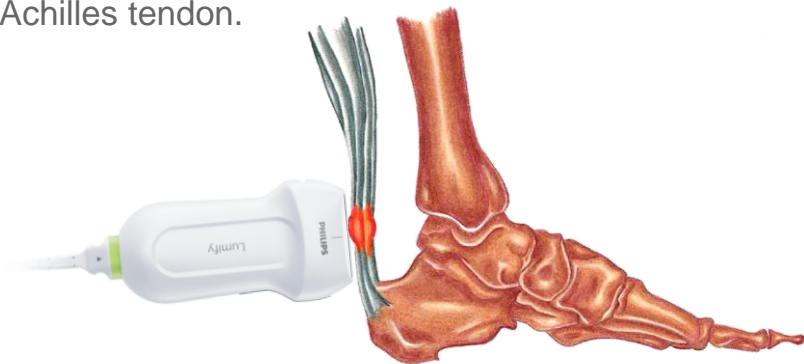
BACKGROUND

Numerous physiotherapy interventions have been proposed for the rehabilitation of Achilles tendinopathy. These interventions predominantly seek to improve the biological integrity of the Achilles tendon to reduce impairments, optimize abilities, and maximize social participation.

Although musculoskeletal ultrasound imaging allows physiotherapists to measure *in vivo* integrity of the Achilles tendon, there is no consensus on which outcome measures are most appropriate.

PURPOSE

This exploratory study aims to identify quantitative ultrasound measures that can best characterize the biological integrity of the Achilles tendon.

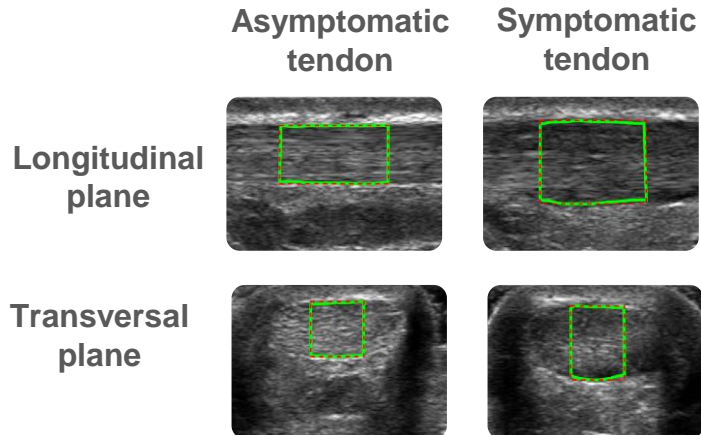


METHODS

Ten individuals with a unilateral Achilles tendinopathy underwent a laboratory assessment during which longitudinal and transversal Achilles tendon ultrasound images were recorded bilaterally by a trained physiotherapist.

Geometrical measures (cross-sectional area, mean thickness), grayscale histogram properties (echogenicity, variance, skewness, kurtosis and entropy) and Haralick features (contrast, energy and homogeneity) were calculated using a MATLAB™ image processing toolbox developed by our research team.

Paired Student's t-test was used for each measure to verify if there was a significant difference between groups ($p < 0,05$).



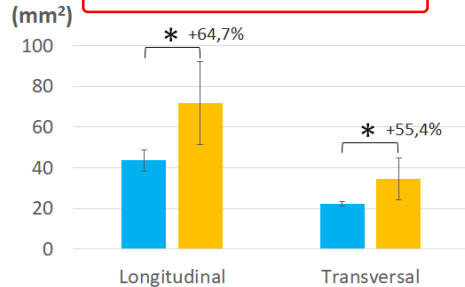
Experimental set-up

RESULTS

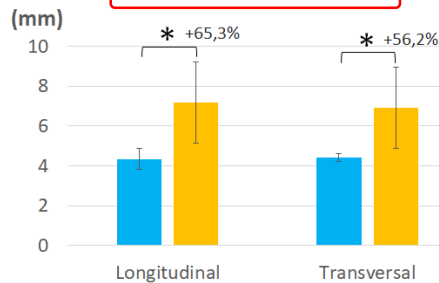
Compared to the asymptomatic side, the symptomatic Achilles tendon had an increased cross-sectional area, mean thickness and skewness, and decreased echogenicity. Variance, kurtosis and entropy were similar between both sides.

Geometrical measures

Cross-sectional area

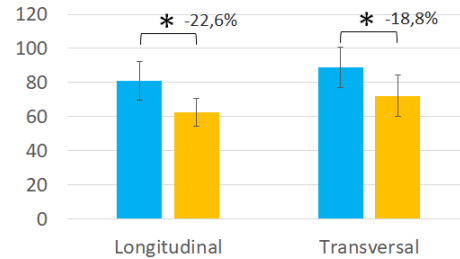


Mean thickness

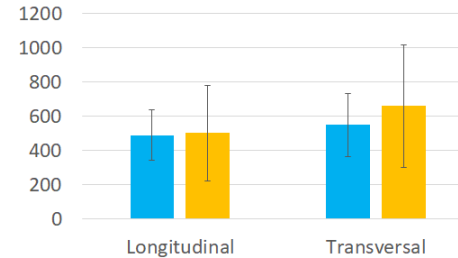


Grayscale histogram properties

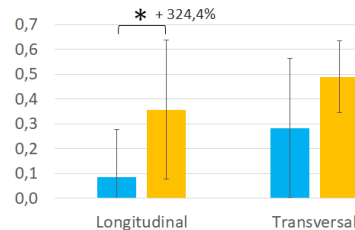
Echogenicity



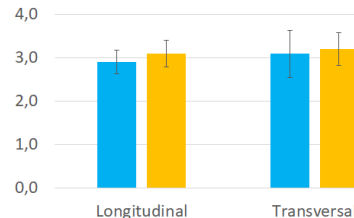
Variance



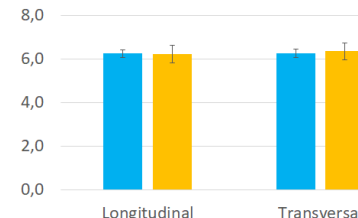
Skewness



Kurtosis



Entropy

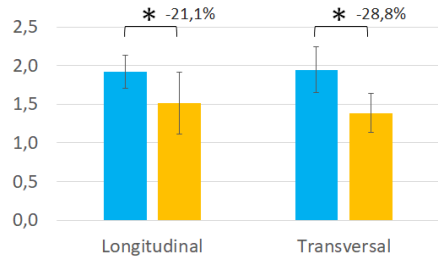


RESULTS

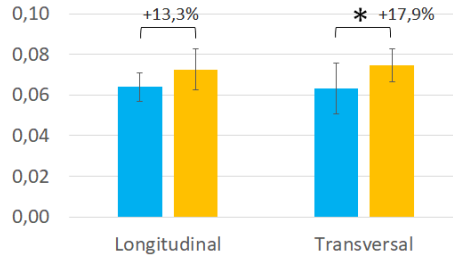
Compared to the asymptomatic side, the symptomatic Achilles tendon had an increased energy and homogeneity, and decreased contrast.

Haralick features

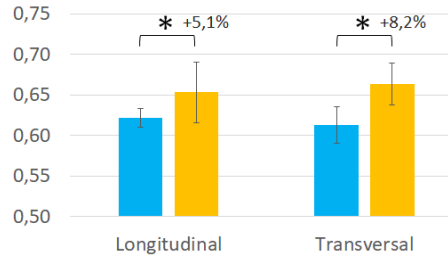
Contrast



Energy



Homogeneity



CONCLUSION

A subset of 7 quantitative ultrasound measures may best characterize the biological integrity of the Achilles tendon. Additional research with an extended group of participants (n=50) will assess the discriminative validity of these measures and their collinearities before recommending a minimal data set. Relation between the minimal data set and clinical evaluation measures will also be made.