

Non-rigid speckle tracking exploratory study for tendinopathy signaling in symptomatic subjects

C. Carvalho¹, S. Bogaerts², L. Scheys³, J. D'hooge⁴, K. Peers², Frederik Maes¹, P. Suetens¹

¹KU Leuven, ESAT/PSI & UZ Leuven, MIRC iMinds, Medical IT Dept, KU Leuven, and UZ Leuven, ²Dept. of Development and Regeneration, ³Dept. of Orthopedics, ⁴Dept. of Cardiovascular Sciences

Introduction: Tendinopathies are one of the most common musculoskeletal injuries affecting both professional and recreational athletes. Knowledge on tendon biomechanics is scarce and limited to some studies regarding global strain and local tissue deformation estimates in healthy subjects [1,2]. The objective of this study was therefore to investigate differences in the biomechanical behavior at the level of local tissue deformation between asymptomatic and symptomatic subjects.

Methods: High-frequency dynamic (2D+t) US data of both Achilles tendons of 10 asymptomatic subjects and of the symptomatic Achilles tendon of 8 subjects were acquired. Symptomatic subjects were classified based on clinical interpretation of symptoms and morphological appearance on US in three groups: less severe (C1), medium severe (C2) and very severe (C3) tendinopathy.

A non-rigid speckle tracking method was applied to each 2D+t US images, yielding the tissue deformation along the major deformation direction in each tendon voxel. Four sub-regions were defined within the tendon, corresponding to proximal/distal and superficial/deep tendon regions.

Mean deformation for each subject was evaluated by averaging the deformation of the 4 sub-regions at the maximum isometric contraction point. Comparison between symptomatic and asymptomatic group (C2+C3) was evaluated using a two-tailed homoscedastic t-test and a ROC analysis was also performed between the two groups.

Results: No significant differences ($p=0.06$) were found between asymptomatic ($n=20$) and symptomatic ($n=10$) subjects. However, when comparing more severe symptomatic cases (C2+C3, $n=7$) with asymptomatic subjects, significant differences ($p=0.02$) were found. ROC analysis between asymptomatic and more severe symptomatic cases (C2+C3) returned an area under the ROC curve (AUC) of 0.83.

Discussion: We show here, for the first time, preliminary results that allow the local biomechanical discrimination between more severe tendinopathy cases and asymptomatic cases. Due to the small size of the datasets, more symptomatic images should be further acquired. Further investigation should also be done for symptomatic subjects within C1 since these subjects present tissue deformation values close to the ones presented by asymptomatic subjects. This close range of deformation values may then be the reason for the non-significant difference found between asymptomatic and symptomatic cases.

References:

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Presenting Author E-mail address:

stijn_bogaerts@hotmail.com or stijn.1.bogaerts@uzleuven.be

Presentation: Oral or Poster