**Impact of Time of Day on measures of Achilles tendon stiffness using shear wave elastography**

Background: There is a noted lack of systematic reports with regards to the mechanical properties of tendon structures, and whether stiffness alters throughout the course of a normal day. Morning stiffness is a commonly reported symptom in patients with Achilles tendinopathy. This is the first study to directly assess whether stiffness of the human in vivo Achilles tendon and wider gastrocnemius-soleus complex alters throughout a day, as measured using shear wave elastography (SWE).

Methods: Fifteen healthy men and women (Mean ± SD) 27.7 ± 4.1 years, height 176.1 ± 7.7cm and weight 71.3 ± 7.1 kg were measured at 08:00, 12:30 & 17:00. Shear wave elastograms taken at varying points in the gastrocnemius-soleus complex. To assess transducer orientation, 4 different measures were taken of medial and lateral gastrocnemius muscles on dominant side. All measures were taken with a Siemens ACUSON S3000™ HELX EVOLUTION Ultrasound System (Siemens Medical Solutions, USA).

Results: No significant differences (p>0.05) over the three measured time points in the shear wave velocity of participants dominant musculo-tendinous junction (p=0.114), mid soleus muscle (p=0.223), (p=0.648) or lateral gastrocnemius muscle (p=0.159) or non-dominant Achilles tendon (p=0.143). Possible trends noted for alterations in shear wave velocity of dominant Achilles tendon & junction of soleus and gastrocnemius muscles (p = 0.094, = 0.16 & p=0.050, = 0.19 respectively). Results obtained from four different transducer orientations were significantly different from each other for medial (p = < 0.001, = 0.56), and lateral gastrocnemius muscles (p = 0.001, = 0.53).

Conclusions: The results demonstrate that time of day does not significantly alter the stiffness of the Achilles tendon and wider gastrocnemius soleus complex in normal subjects. This still needs to be evaluated in pathological tendons. Significant alterations were noted with different probe orientations, therefore orientation should be standardised when assessing results from pennate muscles.