Purpose: Develop, validate and apply noninvasive ultrasound elasticity imaging (UEI) of the human posterior tibial tendon (PTT) as a potential tool to diagnose different stages of PTT disorders and guide treatment of PTT dysfunction in the clinic.

Methods: We have developed ex vivo and in vivo platforms to develop UEI of the PTT. Healthy PTTs from four cadaveric feet were dissected at the proximal end and attached to a materials testing system (MTS) for controlled force/stroke production and measurement. Longitudinal ultrasound images of the tendon were collected at 80 Hz using a 14 MHz clinical ultrasound probe and scanner (Zonare Medical Systems) during force production up to 60 kg. Displacement maps between successive ultrasound frames were obtained using 2D phase sensitive cross–correlation tracking. Mechanical properties of each tendon were estimated from both MTS and ultrasound measurements. This system complements our in vivo platform for UEI of the human PTT.

Results: In the ultrasound movies, the PTT can be easily distinguished from superficial soft tissue and malleolus. Young's modulus of PTT was found to be similar across specimens and range of loads tested. The average Young's modulus was found to be 0.24 ± 0.05 GPa for the MTS and 0.62 ± 0.15 GPa for the ultrasound measurements. This difference was expected because the MTS measurement included properties of support material in series with the tendon. We have also extended our platform for in vivo and noninvasive ultrasound strain imaging of the PTT in human volunteers. Initial results suggest that this approach is a potentially powerful tool to diagnose and identify stages of PTTD for helping determine optimal treatment strategies.

Conclusions: This study demonstrated the feasibility of using ultrasound to noninvasively track mechanical properties of the PTT. Further studies are needed to compare the elastic properties of diseased versus healthy tendon.

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