

Are Local Mechanical Factors Related to Plantar Fascial Thickness?

S.C. Wearing^{1,2}, J.E. Smeathers³, S.R. Urry³, S.L. Hooper², P.M. Sullivan⁴, B Yates⁴, P Dubios⁴

¹Bioengineering, University of Strathclyde, Glasgow, Scotland; ²Centre of Excellence for Applied Sport Science Research, Queensland Academy of Sport, Queensland, Australia;

³Institute of Health and Biomedical Innovation, Queensland University of Technology, Queensland, Australia; ⁴Queensland X-ray, South Brisbane, Queensland, Australia. Ph +61 7 3138 6024; fax +61 7 3138 6030; e-mail: j.smeathers@qut.edu.au

BACKGROUND. Recent research has indicated that the morphology of the plantar fascia may be related to the regional loading of the foot. However, the effect appears to occur only in individuals with diabetes [1]. As such, it is unclear if it represents a systemic change in connective tissue structures or a local change associated with altered foot mechanics. The aim of the current investigation, therefore, was to investigate potential relationships between sonographic measures of plantar fascial thickness, radiographic measures of arch shape, and regional loading of the foot in healthy individuals with and without heel pain.

METHODS. Ten individuals with unilateral plantar fasciitis and ten age, sex and weight matched controls participated in the study which received university ethics clearance. Heel pain on weight-bearing was measured by a visual analogue scale. Fascial thickness and static arch shape were determined from bilateral sagittal sonograms and weight-bearing lateral foot radiographs, respectively. Regional plantar loading of the foot was estimated from a pressure platform using a midgait collection protocol. Relationships between variables were investigated using scatter plots and Pearson product-moment correlations.

RESULTS. The plantar fascia of the symptomatic limb was 48% thicker (6.1 ± 1.4 mm) than its asymptomatic counterpart (4.2 ± 0.5 mm) and 75-79% thicker than the fascia of the matched control limbs (3.4 ± 0.5 mm and 3.5 ± 0.6 mm). Heel pain was correlated with fascial thickness ($r=0.68$, $P<0.01$), arch shape ($r=0.76$, $P<0.01$), and midfoot loading ($r=0.76$, $P<0.01$) in the symptomatic foot. Fascial thickness, in turn, was positively correlated with arch shape in symptomatic ($r=0.89$, $P<0.05$) and asymptomatic ($r=0.64$, $P<0.05$) feet. Fascial thickness was also correlated with peak midfoot load but only in the symptomatic foot ($r=0.66-0.79$, $P<0.05$). No significant correlations were found among the sagittal thickness of the plantar fascia, arch shape and regional loading in control limbs.

DISCUSSION AND CONCLUSION. Sagittal thickening of the plantar fascia has been widely documented in plantar fasciitis but this study is the first to demonstrate that sonographic thickness of the plantar fascia is positively related to the severity of heel pain, and the regional loading and static shape of the arch of the symptomatic foot. While the effect is absent in individuals without plantar fasciitis, it is unknown if these physical characteristics contribute to the development of plantar fasciitis, or occur as a result of gait adaptations secondary to heel pain.

REFERENCES.

- [1] D'Ambrogi E, Giurato L, D'Agostino MA, et al. Contribution of plantar fascia to the increased forefoot pressures in diabetic patients. *Diabetes Care*, 26(5):1525-1529, 2003.