THE EFFECT OF PLANTAR FASCIA RELEASE ON STRAIN IN THE SPRING AND LONG PLANTAR LIGAMENTS

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Introduction: The plantar fascia, spring and long plantar ligaments are the most important static stabilizers of the foot. Plantar fascia release is a common orthopedic procedure used primarily for the treatment of intractable plantar fasciitis. Clinical studies with short-term follow-up have shown favorable results. Long-term follow-up suggests that significant chronic problems may arise. The biomechanical consequences of plantar fascia release are poorly understood. Previous in vitro studies have shown that release of the plantar fascia increases intertarsal instability, decreases longitudinal and transverse arch heights and changes forefoot loading patterns. The effect on the soft-tissue stabilizers has not been directly investigated to our knowledge. In this study we have examined the effect of plantar fascia release on spring and long plantar ligament strain patterns. We hypothesize that release of the plantar fascia will increase the observed strain in these ligaments.

Methods: After exposing the plantar fascia, spring and long plantar ligaments in eleven previously frozen foot and ankle specimens, one DVRT microstrain gauge (Microstrain, Burlington, VT) with a resolution of 1.5 micrometers was placed into each structure. The foot was secured to the loading frame. An axial load was cyclically applied to the foot from 0 to 920N using displacement control until hysteresis was observed in all structures. Control data was then recorded. The plantar fascia was sharply transected while the foot remained on the loading apparatus. The foot was then cyclically loaded until hysteresis was again observed in the ligaments. The mean strain values for each specimen at specific loads in the experimental and control conditions were compared using the paired student’s t-test.

Results: In the intact condition, all of the structures examined demonstrated hysteresis. Elongation was first observed at low load (<150N) in all structures and continued throughout the loading cycle. After release of the plantar fascia, all of the spring ligaments and ten of the eleven long plantar ligaments showed increased strain relative to the intact condition. This increase became significant (p=.05) at loads of less than 150N for both ligaments. Loads of 920N resulted in an average 56% increase in strain for the spring ligament (p=.005) (see figure) and 106% increase in the long plantar ligament (p=.048).

Conclusion: We have demonstrated that in the intact condition the plantar fascia, spring and long plantar ligaments undergo progressive elongation starting at low loads and continuing to at least 920N of axially applied load. After release of the plantar fascia, significantly increased strain was observed in the spring and long plantar ligaments. These increases became apparent at low loads and grew throughout the loading cycle, suggesting that forces which are normally neutralized by the intact plantar fascia during axial loading were at least partially transferred to the spring and long plantar ligaments. These findings elucidate the synergistic relationship of the plantar structures in stabilizing the foot and underscore the fundamental role of the plantar fascia. They also support the hypothesis that the foot absorbs force and resists deformation through both the truss and beam mechanisms. These results also suggest a physiologic mechanism to account for some of the long-term clinical consequences observed after plantar fascia release.