Plantar Fasciitis and Functionality in Gait

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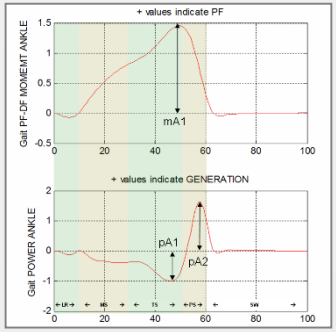

Fig.1. Sagittal plane ankle joint moment & power parameters during walking at a comfortable self selected speed for a typical subject in the study.

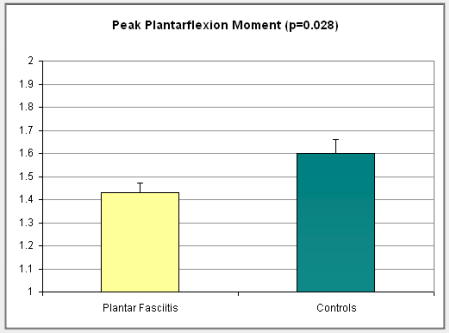

Fig. 2. Maximum plantarflexion moment (**mA1**) during gait for patients with PF compared to non-symptomatic controls.

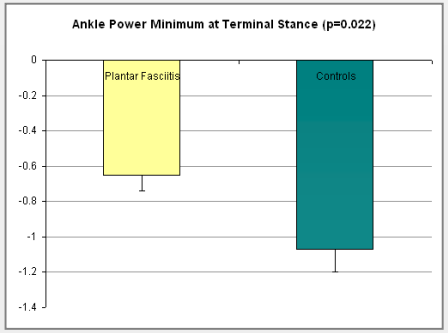

Fig. 3. Maximum power absorption (**pA1**) by the plantarflexors during the terminal stance phase in gait for patients with PF compared to non-symptomatic controls.

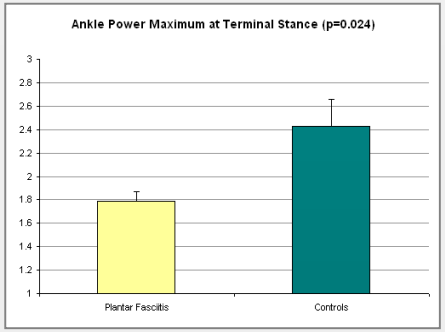

Fig. 4. Maximum power generation (**pA2**) by the plantarflexors during the pre-swing phase in gait for patients with PF compared to non-symptomatic controls.

Background

Plantar fasciitis is a painful condition of the bottom of the foot that is reported to affect up to 15% of all foot symptoms requiring professional care(1). This includes athletically active, sedentary, and geriatric populations. Due to exacerbation of this pain during most weight-bearing activities including walking, plantar fasciitis can be a very limiting condition.

Plantar fasciitis is readily associated with post-static dyskinesia. During these painful episodes, the affected individual will likely adapt his or her gait to decrease the sensation of pain. In chronic cases, habituation may cause these antalgic adaptations to become part of an individual's gait during non-painful periods.

Purpose

The objective of this study is to assess the differences in gait patterns of individuals with plantar fasciitis compared to those without.

Methods

Using a 3-dimensional motion analysis system, the gait of nine healthy subjects and eight subjects with plantar fasciitis was captured and examined. All subjects were barefoot. The joint angles, moments and powers were processed using Orthotrak (ver. 6.2.9). T-tests were used to identify differences between groups.

Results

The plantar fasciitis group exhibited a decreased peak plantarflexion moment (p=0.028, fig. 2), a decreased ankle negative power at terminal stance (p=0.022, fig. 3), and a decreased positive ankle power at pre swing (p=0.024, fig. 4) when compared to control groups.

Interestingly, there were no significant differences in ankle, knee, or hip angles between groups. This suggests that the primary means of antalgic adaptation in the plantar fasciitis group may be in variables that we were not able to measure such as hallux dorsiflexion or pronation at the subtalar joint.

Discussion

One possible explanation for these changes involves the Windlass mechanism. The differences in the three above figures all occur during the terminal stance phase of gait (50-60% of the gait cycle). This point in the gait cycle is also where both ankle and hallux dorsiflexion angles reach a maximum. According to the Windlass mechanism, this is where the plantar aponeurosis is maximally stressed (2). Theoretically, this point in time would elicit the most pain in someone with plantar fasciitis, which could result in habitual guarding. If the condition persisted long enough, the plantarflexors may become weakened over time resulting in decreased moments and powers around the ankle. Clinically, this would merit strengthening and retraining of the plantarflexors.

In addition limitation in lengthening of the tibialis posterior, flexor hallucis longus and flexor digitorum longus muscles may also explain these findings. Potentially, these muscles maybe used by the plantar fasciitis patients to reduce dorsiflexion of the ankle and hallux.

Conclusion

The above changes exhibit that plantar fasciitis results in a functional limitation in gait. These changes may be the result of weakened ankle plantarflexors. Clinically, rehabilitation of these muscles may help improve the patient's gait function

Further research should involve methods to determine the exact cause of these changes, as well as whether these changes persist once the symptoms of plantar fasciitis have resolved.

Acknowledgements

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References

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