Research Paper Review

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High-load strength training improves outcome in patients with plantar fasciitis: A randomized controlled trial with 12-month follow-up

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Reviewed by Dr. Jeff Muir DC (Research Review Service)

ABSTRACT

The aim of this study was to investigate the effectiveness of shoe inserts and plantar fascia-specific stretching vs shoe inserts and high-load strength training in patients with plantar fasciitis. Forty-eight patients with ultrasonography-verified plantar fasciitis were randomized to shoe inserts and daily plantar-specific stretching (the stretch group) or shoe inserts and high-load progressive strength training (the strength group) performed every second day. High-load strength training consisted of unilateral heel raises with a towel inserted under the toes. Primary outcome was the foot function index (FFI) at 3 months. Additional follow-ups were performed at 1, 6, and 12 months. At the primary endpoint, at 3 months, the strength group had a FFI that was 29 points lower [95% confidence interval (CI): 6–52, P = 0.016] compared with the stretch group. At 1, 6, and 12 months, there were no differences between groups (P > 0.34). At 12 months, the FFI was 22 points (95% CI: 9–36) in the strength group and 16 points (95% CI: 0–32) in the stretch group. There were no differences in any of the secondary outcomes. A simple progressive exercise protocol, performed every second day, resulted in superior self-reported outcome after 3 months compared with plantar-specific stretching. High-load strength training may aid in a quicker reduction in pain and improvements in function.

ANALYSIS

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Background Information
Plantar fasciitis (PF) is the most common cause of heel pain (1, 2) and is characterized by pain at the calcaneal origin of the plantar fascia, often accompanied by thickening of the fascia itself (2).

While the histology of PF is poorly understood, it is known that degenerative changes at the plantar fascia enthesis contribute to pain and dysfunction (3, 4).

Randomized controlled trials have demonstrated that plantar fascia-specific stretching and shoe inserts are effective in the treatment of PF (5); however, with 40% of patients reporting persistence of symptoms up to 2 years following diagnosis (6), new treatment approaches are warranted. Stretching is generally recommended as a part of a treatment plan although, recently, high-load strength training has shown promise. High-load strengthening causes high tensile loads across the tendon, which may yield a higher treatment effect than simple stretching (7).

The purpose of the current study was to investigate the effectiveness of shoe inserts and plantar fascia-specific stretching compared to shoe inserts and high-load strength training consisting of unilateral heel raises and dorsal flexion of the metatarsophalangeal joints in patients with plantar fasciitis.

Pertinent Results

Participants

48 patients were randomized to receive either plantar-specific stretching and shoe inserts (n = 24) or high-load strength training and shoe inserts (n = 24). 3-month follow-up was obtained in 81% of participants.

Primary Outcome

At the primary endpoint at 3 months, the strength group had a foot function index (FFI) that was 29 points lower (95% confidence interval [CI]: 6–52, p = 0.016) compared with the stretch group (ES: 0.81). This exceeds the 7-point difference required to signify a clinically important difference. Non-significant differences were noted at 1, 6 and 12 months. At 12-months, there was a trend towards improved status (based on FFI scores) in the stretch group versus the strength group (16 vs. 22).

Secondary Outcome

Patients randomized to the strength group reported significantly less ‘worst’ foot pain at the primary endpoint at 3 months. No other significant differences were noted, however there was a trend towards greater satisfaction at 3 and 12 months in the strength group.

Clinical Application & Conclusions

Clinical improvement was noted at 3 months in patients with plantar fasciitis who completed a short, high-load strength training program when compared with a stretching program. No significant difference was noted at 6 or 12 months. While a strengthening program such as this may be of benefit to patients suffering from plantar fasciitis, the lack of a lasting effect indicates the need for further research. In combination with manual and/or modality treatments, incorporating a high-load strengthening program may prove to be a valuable addition to a treatment plan for plantar fasciitis, a condition that remains challenging to manage clinically.

Study Methods

Study design
This study was a randomized, controlled trial conducted at 2 hospitals and 1 private clinic in northern Denmark. Patients were recruited between 2009 and 2012.

Participants

Inclusion Criteria:

- History of inferior (plantar) heel pain for at least 3 months before enrollment,
- Pain on palpation of the medial calcaneal tubercle or the proximal plantar fascia, and
- Thickness of the plantar fascia of 4.0 mm or greater.

Exclusion Criteria:

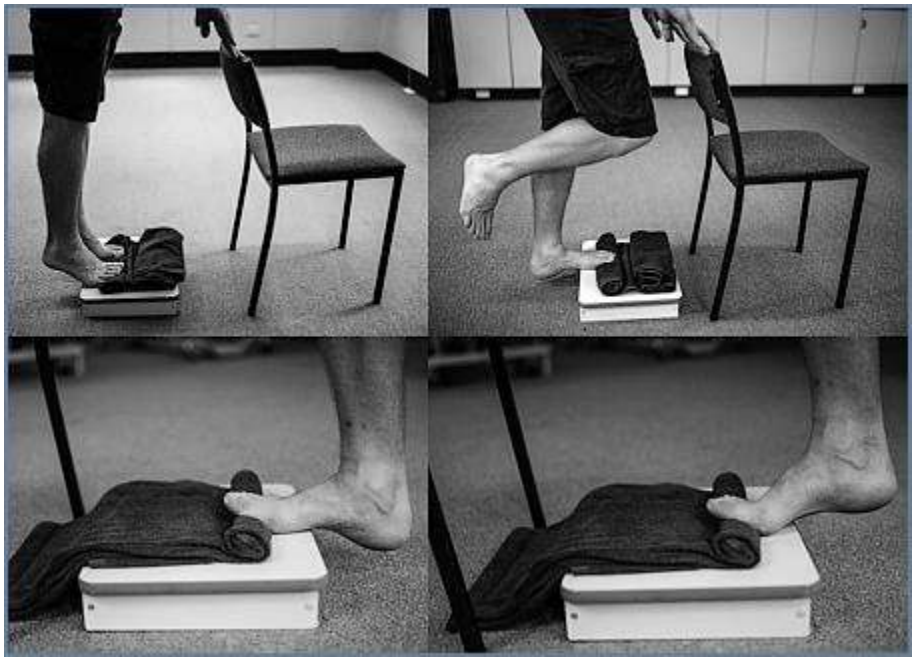
- Below 18 years of age,
- History of systemic diseases,
- Prior heel surgery,
- Pregnant, or
- Corticosteroid injection for plantar fasciitis within the previous 6 months.

Randomization
48 patients with ultrasonically-confirmed plantar fasciitis were block randomized to receive shoe inserts and either daily plantar-specific stretching ("stretching" group) or high-load strength training every other day ("strength" group).

The principle investigator met with all treating and assessing clinicians prior to beginning the trial to ensure consistency of diagnosis, intervention and information delivered to patients. Participants were assessed at baseline by a rheumatologist or orthopaedic surgeon and subsequently referred to a physiotherapist. Patients were re-assessed at 1 month by the same physician, who performed ultrasonographic measurement of the thickness of the plantar fascia.

Interventions:

- *Patient Education & Shoe Inserts*: Both groups received a short patient information sheet (providing information regarding pain management, modification of physical activity and return to sports) and gel heel inserts (Tuli's polar bear gel heel cups).
- *Plantar-Specific Stretching* (see picture below): Plantar fascia stretching required patients to sit crossing the affected leg over the contralateral leg. Then, while using the hand on the affected side, they were instructed to place the fingers across the base of the toes on the bottom of the foot (distal to the metatarsophalangeal joints) and pull the toes back toward the shin until they felt a stretch in the arch of the foot. Patients were instructed to palpate the plantar fascia during stretching to ensure tension in the structure. Patients were instructed to perform the stretch 10 times, holding for 10 seconds, three times per day.
- *High-Load Strength Training* (see picture below): High-load strength training consisted of unilateral heel raises with a towel inserted under the toes. Patients were instructed to perform the stretch on a stairway or similar location. Patients were instructed to perform the exercises every second day for 3 months. Each heel raise consisted of a 3-second concentric phase (going up) and a 3-second eccentric phase (coming down) with a 2-second isometric phase (pause at the top of the exercise). Exercises began at a 12-repetition maximum for 3 sets and after 4 weeks, progressed to 5 sets of 8-repetitions. A backpack with books was added at 2 weeks and the load in the backpack was increased over the course of the trial.



Outcomes:

- *Primary Outcome:* Primary outcome consisted of the change in total Foot Function Index (FFI) from baseline to 3-month follow-up. The FFI is a self-report questionnaire that assesses multiple dimensions of foot function.

- *Secondary Outcomes:* Secondary outcomes included the thickness of the plantar fascia, satisfaction with the result of the treatment, physical activity level measured as sports participation, and average leisure time sports participation per week.

Statistical Analysis
All analyses took place after the 12-month follow-up and no intermediate analyses were performed. Between-group comparisons were analyzed using an intention-to-treat approach. Linear regression was used to analyze the outcomes.

Study Strengths / Weaknesses

Limitations

- No data were obtained on adherence to exercises or the quality of the home-based exercises,
- Exercises were performed at home, without monitoring for correctness of activity, and
- Exercise frequency was very different in the two groups and it is unknown if this will affect compliance and thereby outcome.

Strengths

- All patients were recruited from the normal patient flow at the three clinical sites, and
- The addition of high-load strength training to heel insert and patient education are easy to implement as it only requires standard equipment such as a towel and a backpack.

Additional References

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