The Effectiveness of a Gastrocnemius–Soleus Stretching Program as a Therapeutic Treatment of Plantar Fasciitis

Troy R. Garrett and Peter J. Neibert

Clinical Scenario: Injury to the plantar fascia, whether acute or chronic, is common among many populations. A conventional multiple-treatment approach is commonly administered by health care providers, consisting of controlling inflammation, managing pain, and promoting healing. Frequently, the initial treatment for plantar fasciitis is targeted at increasing dorsiflexion range of motion by stretching the gastroc-soleus musculature. It has been theorized that inflexibility of the gastroc-soleus complex can lead to excessive pronation and overcompensation of the plantar fascia at the first metatarsal phalangeal joint, therefore increasing the stress at the medial calcaneal insertion. Therefore, it is deemed that gastrocnemius–soleus stretches are a beneficial treatment in the initial stage of a plantar fasciitis treatment or rehabilitation program.

Focused Clinical Question: Is a gastrocnemius–soleus stretching program, as a stand-alone treatment variable, effective in the treatment of plantar fasciitis?

Keywords: heel pain, evidence-based practice, outcomes

Summary of Search, “Best Evidence” Appraised, and Key Findings

- The literature was searched for studies of level 4 evidence or higher that investigated effects of gastrocnemius–soleus stretching as a treatment for plantar fasciitis.
- The literature search returned 12 possible studies related to the clinical question; four studies met the inclusion criteria and were included.
- Eight studies were excluded primarily because they combined other treatment variables with gastrocnemius–soleus stretching.
- Three level 1b randomized controlled trials were included. One level 2b study was included.
- Two studies reported that stretching of the plantar fascia was significantly more effective than gastrocnemius–soleus stretching as a treatment.1,2
- One study reported that gastrocnemius–soleus stretching was not significantly different from sham ultrasound as a treatment.3
- One study reported that calcaneal taping was significantly more effective than gastrocnemius–soleus and plantar fascia stretching.4
Clinical Bottom Line

There is no evidence to support gastrocnemius–soleus stretching as a stand-alone variable in the treatment of plantar fasciitis.

Strength of Recommendation: There is level A evidence suggesting no significant difference in outcomes of gastrocnemius–soleus stretching when compared with a control group or other interventions. Caution should be used in interpreting these findings based on the limited samples to draw from, suggesting that further investigation is warranted.

Search Strategy

Terms Used to Guide Search Strategy
- Patient/Client group: no restrictions
- Intervention/Assessment: stretching or flexibility or treatment
- Comparison: control or other treatments
- Outcome: plantar fascia or plantar fasciitis or heel pain or plantar fasciopathy

Sources of Evidence Searched
- PEDro Database
- PubMed
- Medline
- CINAHL
- EBSCO
- Elsevier
- Google Scholar
- Review of reference lists

Inclusion and Exclusion Criteria

Inclusion Criteria
- Studies investigating plantar fasciitis with gastrocnemius–soleus stretching as a stand-alone treatment variable
- Level 4 evidence or higher
- Limited to English language
- Limited to humans
- Limited to last 11 years (2002–2012)

Exclusion Criteria
- Studies investigating plantar foot pain not associated with plantar fasciitis

Results of Search

Four relevant studies\(^1\)–\(^4\) were retrieved and reviewed, as shown in Table 1 (based on Levels of Evidence, Centre for Evidence-Based Medicine, 2009). DiGiovanni\(^1\)–\(^2\) concluded that plantar fascia stretching was significantly better than gastrocnemius–soleus stretching after 8 weeks\(^1\) and 2 years\(^2\) but did not compare the findings with those of a control group. Radford\(^3\) found no significant difference between the gastrocnemius–soleus-stretching group and control group, and both showed improvement after 2 weeks. After 1 week of intervention, Hyland\(^4\) showed a significantly higher decrease in pain between gastrocnemius–soleus stretching and a control group, but no difference in the patient-specific functional scale.

Best Evidence

The 4 studies were identified as the best evidence and selected for inclusion in this critically appraised topic (Table 2). Reasons for selecting these studies were that they were graded with the highest level of evidence (1b or 2b) and studied the effect of gastrocnemius–soleus stretching on plantar fasciitis.

Implications for Practice, Education, and Future Research

As a stand-alone treatment, none of the 4 articles showed gastrocnemius–soleus stretching to be as effective as plantar fascia–specific stretching, calcaneal taping, or a control group. Clinicians should be cautious when interpreting these findings due to the discrepancy in the durations and frequencies of the stretching treatments. None of the studies actually investigated the efficacy of their stretching protocols; therefore, it is not possible to assess whether flexibility changes occurred. Results

Table 1 Summary of Study Designs of Articles Retrieved

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>Study design</th>
<th>Number located</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1b</td>
<td>Randomized controlled trial</td>
<td>3</td>
<td>DiGiovanni et al(^1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Radford et al(^3)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Hyland et al(^4)</td>
</tr>
<tr>
<td>2b</td>
<td>Cohort</td>
<td>1</td>
<td>DiGiovanni et al(^2)</td>
</tr>
</tbody>
</table>
### Table 2 Characteristics of Included Studies

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>DiGiovanni et al(^1)</th>
<th>DiGiovanni et al(^2)</th>
<th>Radford et al(^2)</th>
<th>Hyland et al(^4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study design</td>
<td>Randomized clinical trial</td>
<td>Cohort study</td>
<td>Randomized control trial</td>
<td>Randomized control trial</td>
</tr>
<tr>
<td>Participants</td>
<td>101 patients (33 men and 68 women) who had chronic heel pain for at least 10 mo.</td>
<td>82 patients performed a 2-y follow-up of the DiGiovanni et al(^1) study.</td>
<td>92 participants with clinical diagnosis of plantar heel pain.</td>
<td>42 participants with plantar fascia pain.</td>
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<tr>
<td></td>
<td>Failure to respond to previous nonoperative treatments: NSAIDs, orthoses, heel cups, exercises, night splints, injections, and/or activity modifications.</td>
<td>Participants of group B, after 8 wk of Achilles stretching, were trained and performed plantar fascia stretching.</td>
<td>Participants must have localized pain at the plantar heel, worst when first standing or walking, and improved initially after first standing but worsened with increasing activity.</td>
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<tr>
<td></td>
<td>Exclusions: Hx of systemic disease, prior heel surgery, not plantar fascia heel pain.</td>
<td>66 participants completed the study, for an 80% response rate.</td>
<td>Excluded if history included any inflammatory, osseous, metabolic, or neurological abnormalities or if had received corticosteroid injection within 3 mo.</td>
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<tr>
<td></td>
<td>Sequence of random allocation concealed until interventions were assigned.</td>
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<td>Random allocation by computer program, sequence concealed in envelopes.</td>
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<td></td>
<td>Group similar in age, BMI, and hours standing per day, with the exception of duration of symptoms ((P &lt; .001)); group A had participants clustered at extremes while group B was more evenly distributed.</td>
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<td>No differences between groups.</td>
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<td></td>
<td>Both groups given OTC prefabricated full-length soft insoles, 3 wk course of Celebrex, and viewed educational video about plantar fasciitis.</td>
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<td>No participants were lost at follow-up.</td>
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<td></td>
<td>19 participants were lost at follow-up 8 wk later, return rate, 81.2%</td>
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<tr>
<td>Intervention investigated</td>
<td>Group A performed plantar fascia stretching (3 \times/d, 10) reps, hold for 10 s (including before getting out of bed).</td>
<td>After initial 8 week study,(^1) group B changed from Achilles stretching to plantar fascia stretching.</td>
<td>Treatment group performed Achilles stretching for 5 min every day, plus 3 min of sham ultrasound twice a week for 2 wk.</td>
<td>Four treatment groups: Achilles and plantar fascia stretching (2 sessions), calcaneal taping (to correct valgus), control group, and sham taping group. Data were collected after 1 wk.</td>
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<tr>
<td></td>
<td>Group B performed Achilles stretching (3 \times/d, 10) reps, hold for 10 s, including after getting out of bed.</td>
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<td>Control group was administered 3 min of sham ultrasound twice a week for 2 wk.</td>
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</table>

\(^1\)Continued...
Table 2  (continued)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>DiGiovanni et al(^1)</th>
<th>DiGiovanni et al(^2)</th>
<th>Radford et al(^3)</th>
<th>Hyland et al(^4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome measures</td>
<td>Participants answered questions from the Foot Function Index as a baseline, at 4 wk, and at 8 wk.</td>
<td>Participants answered questions from the Foot Function Index, symptom duration, and the need for additional treatment.</td>
<td>Participants were measured for pain first arising in the morning by visual analog scale (VAS). Subjects completed Foot Health Status Questionnaire. Secondary outcome measures were ankle ROM and foot posture.</td>
<td>Participants completed VAS and Patient-Specific Functional Scale (PSFS).</td>
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<td>Main findings</td>
<td>Group A showed significant differences in improvement of worst pain and first steps in the morning. The percentage of positive responses with regard to pain, activity limitation, and patient satisfaction was greater in Group A.</td>
<td>Group B had no significant differences with worst pain and first steps after plantar fascia stretching at 2-y follow-up.</td>
<td>No statistically significant differences between groups for primary or secondary outcomes. Ten participants in the treatment group had adverse effects from stretching.</td>
<td>The postintervention calcaneal-taping group VAS score was significantly lower than the other 3 groups ((P &lt; .05)). The postintervention stretching group’s VAS score was significantly lower than the control group’s ((P &lt; .05)). No significant PSFS differences between the groups.</td>
</tr>
<tr>
<td>Level of evidence</td>
<td>1b</td>
<td>2b</td>
<td>1b</td>
<td>1b</td>
</tr>
<tr>
<td>Validity score</td>
<td>Pedro score 4/10</td>
<td>Pedro score 4/10</td>
<td>NA</td>
<td>Pedro score 4/10</td>
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<tr>
<td>Conclusion</td>
<td>Plantar fascia stretching before first steps in the morning limits repetitive micro-trauma and chronic inflammation.</td>
<td>Reinforces the value of plantar fascia stretching, thus superior to weight-bearing Achilles tendon stretch.</td>
<td>Calf muscle stretching over a 2-wk period produces no statistically significant benefits compared with not stretching.</td>
<td>Calcaneal taping is an effective tool for relief of plantar heel pain.</td>
</tr>
</tbody>
</table>

Abbreviations: NSAIDs, nonsteroidal anti-inflammatory drugs; BMI, body-mass index; OTC, over-the-counter; ROM, range of motion.
may have been different if the frequencies and duration of the stretching treatments had been longer, in that the gastrocnemius–soleus muscles may not have been sufficiently stretched to bring about the necessary gains in flexibility.

While a tight gastrocnemius–soleus may contribute to the pathology, clinicians should not overlook the treatment of the plantar fascia itself. Gastrocnemius–soleus stretching may be beneficial; however, it does not optimally isolate the plantar fascia. Perhaps gastrocnemius–soleus stretching should be viewed as supplemental to plantar fascia–specific stretching. Stretching the plantar fascia itself in the midfoot has been shown to be beneficial. The purpose of plantar fascia–specific stretching is to recreate the windlass mechanism. Theoretically, when this stretch is performed prior to the first morning steps or after prolonged sitting or inactivity, plantar fascia–specific stretching helps limit microtrauma to the plantar fascia, thereby facilitating healing.

Clinicians should take a multifaceted approach to treating a patient with plantar fasciitis. If there are limitations in dorsiflexion, these should be addressed with gastrocnemius–soleus stretching while including plantar fascia–specific stretching. If the patient presents with no dorsiflexion range-of-motion deficiencies, possibly plantar fascia–specific stretching is sufficient.

More research is needed on this topic, as the length of follow-up varied from 1 week to as long as 2 years. Researchers need to take into consideration whether participants with plantar fasciitis have decreased dorsiflexion (ie, less than normal limits) due to gastrocnemius and soleus inflexibility and whether a stretching program increases the range of motion, as well as function. Overall, larger, well-controlled studies are necessary to determine the ideal program of stretching for the treatment of plantar fasciitis.

References