Conservative Treatment of Plantar Fasciitis

A Prospective Study

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A randomized, prospective study was conducted to compare the individual effectiveness of three types of conservative therapy in the treatment of plantar fasciitis. One hundred three subjects were randomly assigned to one of three treatment categories: anti-inflammatory, accommodative, or mechanical. Subjects were treated for 3 months, with follow-up visits at 2, 4, 6, and 12 weeks. For the 85 patients who completed the study, a statistically significant difference was noted between groups, with mechanical treatment with taping and orthoses proving to be more effective than either anti-inflammatory or accommodative modalities. (J Am Podiatr Med Assoc 88(8): 375-380, 1998)

Plantar fasciitis, or heel spur syndrome, is an inflammatory condition that results in pain of the inferior heel. It is an overuse syndrome in which excessive traction of the plantar fascia at its origin on the calcaneus results in localized inflammation. In its acute stage, the discomfort most often is localized to the origin of the medial and central bands at the medial tubercle of the calcaneus. In the chronic stage, discomfort may progress distally along the course of the fascia.[1]

Typically, the disorder is characterized by "first-step pain." This pain occurs after a period of nonweightbearing, such as in the morning when arising from bed. After the first couple of steps, the acute pain usually subsides, either disappearing completely or remaining as a constant ache that worsens again after a period of rest.[2, 3]

The etiology of plantar fasciitis is somewhat controversial, but many factors may contribute to its development. Underlying factors that may precipitate the condition include poor foot mechanics due to pes planus or cavus foot type, obesity, inappropriate footwear, nerve entrapment, tight triceps surae, fat-pad atrophy, and repetitive microtrauma.[4-17]

There is no single universally accepted way of treating plantar fasciitis. The condition frequently responds to a broad range of conservative therapies. Modalities historically used include rest, physical therapy, deep x-ray therapy,[18, 19] nonsteroidal anti-inflammatory drugs (NSAIDs),[2, 8] steroid injections,[20] foot padding,[21, 22] taping,[23] shoe modifications,[24] arch supports,[25, 26] heel cups,[16] custom foot orthoses,[27] night splints,[28] and casting.[29] Few studies of heel pain have comparatively evaluated various conservative treatment modalities.

Initial therapy for plantar fasciitis often falls into one of the following categories: treatment of the in-

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flammation with NSAIDs or steroid injections, treatment of the pain with analgesics or accommodative foot pads, treatment of the pathomechanics with taping or orthoses, or a combination of the above. The purpose of this randomized, prospective study was to compare the various treatment types with respect to pain relief, impact on lifestyle, and overall rate of success.

Materials and Methods

One hundred five patients with plantar heel tenderness, a history of pain upon arising in the morning or after rest (first-step pain), and no history of trauma to the heel within the previous 3 months were enrolled in the study. Patients could not have received any self-treatment or professional treatment, including arch supports, heel cups, injections, or NSAIDs, within 1 month before entry into the study. Radiographic evaluation of all subjects revealed no heel abnormalities except for the occasional presence of an infracalcaneal spur.

After study eligibility was determined, the subjects were randomly assigned to one of three groups. One randomized subject was found to be ineligible for participation in the study because a heel cup was found in his shoe. Another subject was excluded from the study after randomization because of the presence of pathology other than a heel spur on x-ray. Therefore, 103 subjects were entered into the study. All of the subjects gave their informed consent, which was reviewed by an institutional review board.

If the condition was bilateral or developed during treatment in the second foot, the same treatment was provided for both feet. The foot with the highest degree of pain was considered the study foot.

Study follow-up visits occurred for all treatment groups at 2 weeks, 4 weeks, 6 weeks, and 3 months. Evaluations included a visual analog scale to assess the amount of initial discomfort and improvement on a scale of 0 to 10, with 0 symbolizing no pain and 10 severe pain. The reliability and validity of visual analog scales in the measurement of pain have been documented in the literature[30]; furthermore, the strengths and weaknesses of such scales have been critically reviewed.[31]

Group 1 (n = 35) received anti-inflammatory therapy. On the initial visit, the affected heel was injected with 0.5 ml of dexamethasone sodium phosphate 4 mg/ml together with 1 ml of 0.5% bupivacaine hydrochloride without epinephrine at the area of maximum tenderness. Patients also took two 300-mg capsules of etodolac per day. If etodolac was contraindicated, piroxicam 20 mg per day was substituted. These medications were not used if there were contraindications such as hypersensitivity, a history of ulcer disease, or development of gastrointestinal symptoms. At week 2, patients whose visual analog scores had improved by 3 or more points received the same injection. If there was minimal to no improvement in pain, defined as a change in visual analog scale score of 2 points or less, 0.2 ml of dexamethasone acetate 16 mg/ml was added to the above-described injection. The same treatment plan was followed at the third visit at week 4. Because of the possibility of adverse effects such as collagen degeneration, plantar fascia rupture, or fat-pad atrophy, patients were not given more than three successive injections. On the fourth visit at week 6, if there was no improvement or pain had worsened, treatment was considered to have failed and the patient had treatment terminated.

Group 2 (n = 33) received accommodative therapy. On the initial visit, the patient was given a viscoelastic heel cup that was to be used for 3 months. The patient was allowed to take acetaminophen capsules on an as-needed basis for pain, but no NSAIDs were allowed.

Group 3 (n = 35) received mechanical therapy. On the initial visit, plaster impressions were taken in a neutral position for fabrication of orthoses. During the 4-week period before the orthoses were delivered, a low-dye strapping with a long metatarsal pad was applied to the affected foot and changed weekly. Specifically, four 1-inch strips of adhesive cloth tape were placed around the foot from the fifth metatarsal head to the first metatarsal head, encompassing the heel. A ¼-inch felt pad was then placed on the plantar aspect of the foot from the area of heel pain to just proximal to the metatarsal heads and covered with three 3-inch strips of adhesive cloth tape.

The effect of the heel pain on three types of activities—leisure, work, and exercise—was defined as follows: 1) "no effect" meant that the patient reported no effect on any of the three categories of activity; 2) "minimal effect" meant that the patient reported an effect on one category of activity; 3) "occasional effect" meant that the patient reported an effect on two categories of activity; and 4) "constant effect" meant that the patient reported an effect on all three categories of activity. The complaint of "first-step pain" was defined as follows: 1) "none" meant that the patient never complained of first-step pain; 2) "minimal" meant that the patient complained of first-step pain several times a month; 3) "occasional" meant that the patient complained of first-step pain several times a week; and 4) "constant" meant that the patient complained of first-step pain daily.

At the end of 3 months, a final follow-up visit for

each patient occurred, and patients were categorized into "excellent," "fair," and "poor" outcome groups using a threefold definition. An "excellent" outcome was defined as a visual analog scale score of 0 to 2, minimal to no effect on activities, and minimal to no first-step pain. A "fair" outcome was defined as a visual analog scale score of 3 to 5, occasional effect on activities, and occasional first-step pain. A "poor" outcome was defined as a visual analog scale score of more than 5, constant effect on activities, and constant first-step pain.

Demographic information was summarized using descriptive statistics. Differences among the three treatment groups with respect to continuous variables such as patient age, visual analog scale scores, and change in weight were analyzed using analysis of variance and the Duncan multiple range test. Chi-square tests were utilized for categorical variables such as gender, race, effect on activity, first-step pain, termination, and final overall outcome to determine treatment differences. A P value of less than .05 was considered to indicate statistical significance.

Results

Of the 103 patients who participated in the study, 13 had incomplete follow-up and 5 had no follow-up, leaving 85 patients who completed the study.

Twenty-five of the 85 patients had their randomized treatment terminated because of refusal of further treatment, drug reaction, intolerance, or treatment failure. Seventy-six percent (19 of 25) of the treatment terminations were due to treatment failure. A statistically significant difference was noted between the three treatment groups with respect to the chance of termination of treatment ($P < .001$). Twenty-three percent (7 of 31) of the anti-inflammatory group had their treatment terminated and 42% (11 of 26) of the accommodative group had their treatment terminated because of treatment failure; however, only 4% (1 of 28) of the mechanical group had their treatment terminated because of treatment failure. The 25 patients had their treatment terminated anywhere from 3 to 99 days after initial treatment, with a mean termination time of 37 days (Fig. 1).

Patients ranged in age from 19 to 81 years, with an average of 49 years. Height ranged from 56 to 79 inches, with an average of 66.5 inches. Weight ranged from 120 to 288 pounds, with an average of 197.8 pounds. Prior to treatment, the average duration of symptoms for the right foot was 26.5 weeks and that for the left foot was 46 weeks. No statistically significant difference was noted between treatment groups with respect to demographic variables ($P = .91$).

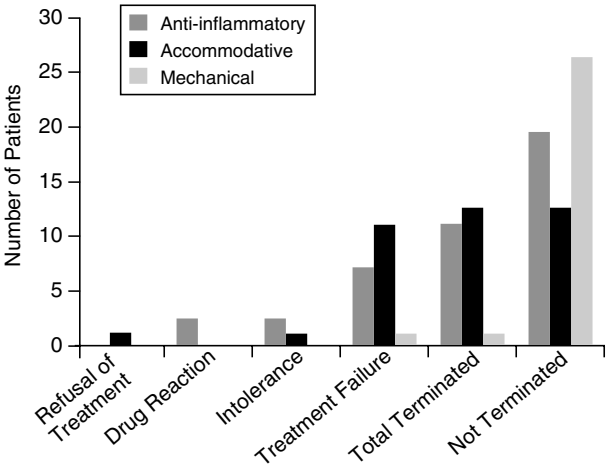

Figure 1. Reasons for treatment termination by treatment group.

No statistically significant differences were found between treatment groups with respect to change in weight from the initial visit to the final visit ($P = .55$). Gender did not affect change in weight. The average change in weight was a 3-pound gain for the anti-inflammatory group, a 2-pound gain for the accommodative group, and a 2-pound gain for the mechanical group. No statistically significant difference in change in weight was found for patients who were referred to a dietitian at the initial visit compared with those who were not referred ($P = .38$; 1-pound gain *versus* 2-pound gain, respectively). The same was true for patients referred to a dietitian at any time before the 3-month visit compared with those who were not referred ($P = .37$; 2-pound gain *versus* 4-pound gain, respectively).

Upon completion of the study, no statistically significant difference was found between the treatment groups with respect to the effect of heel pain on leisure, work, or exercise activities as defined in Materials and Methods ($P = .35$). In other words, activity level was similar among the three treatment groups in those individuals who did not have their treatment terminated. No statistically significant difference was found between the treatment groups with respect to first-step pain complaints upon completion of the study ($P = 0.16$).

No statistically significant difference was noted between treatment groups with respect to the initial visual analog scale score ($P = .64$). However, a difference between treatment groups was observed in the mean change in visual analog scale score over time

(P = .04). There was a statistically significant difference in visual analog scale score change between the accommodative group and the mechanical group. This difference was not observed between the anti-inflammatory and accommodative groups, nor between the anti-inflammatory and mechanical groups (Table 1).

A statistically significant difference was found between treatment groups in final visual analog scale score (P < .01). Forty-five percent (14 of 31) of the patients in the anti-inflammatory group progressed to a visual analog scale score of 0 to 2, 23% (6 of 26) of patients in the accommodative group progressed to a visual analog scale score of 0 to 2, and 64% (18 of 28) of patients in the mechanical group progressed to a visual analog scale score of 0 to 2 (Fig. 2).

A statistically significant difference was found between treatment groups with respect to the achievement of a final outcome of "excellent" or "fair" *versus* a "poor" outcome as defined in Materials and Methods (P = .005). Thirty-three percent (9 of 27) of the anti-inflammatory group had an excellent or fair outcome, 30% (7 of 23) of the accommodative group had an excellent or fair outcome, and 70% (19 of 27) of the mechanical group had an excellent or fair outcome (Fig. 3). Eight patients did not have a final assessment; therefore, their final outcome was not defined.

Table 1. Mean Change in Visual Analog Scale Score of the Three Treatment Groups

Treatment Group	n	Mean Change ± SD
Anti-inflammatory	31	3.4 ± 3.0
Accommodative	26	2.2 ± 3.1
Mechanical	28	4.4 ± 3.1

Discussion

According to the literature, success rates for conservative treatment of plantar fasciitis vary from 46% to 100%.[32] Wolgin et al[32] conducted a retrospective review of 100 patients by means of a telephone survey to assess the long-term results (average follow-up was 47 months) of patients treated conservatively for plantar heel pain. Patients were then classified by their symptoms into three groups: good (indicating no symptoms), fair (indicating continued symptoms without activity limitations), and poor (indicating continued symptoms with activity limitations). These investigators calculated an 82% success rate with various conservative therapies; however, they state that "no statistical comment can be made . . . since the treatments were not applied independently; any given patient could have used more than one treatment at a time."[32(p99)]

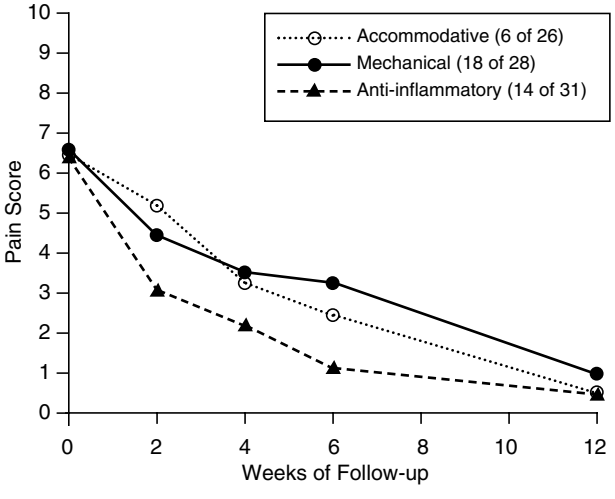

Figure 2. Mean visual analog scale score over time of the patients who arrived at a visual analog scale score of 0 to 2 upon completion of the study (n = 38).

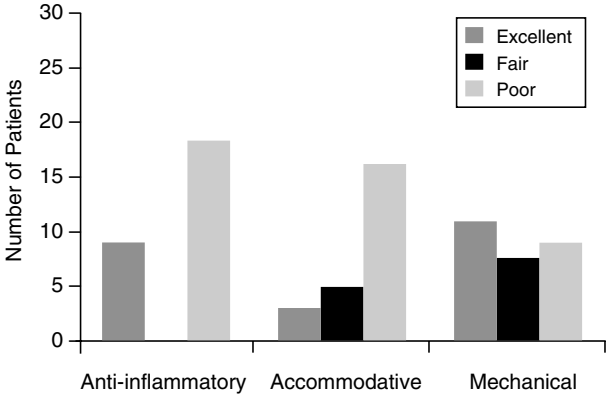

Figure 3. Final assessment. "Excellent" was defined as a visual analog scale score of 0 to 2, minimal to no effect on activities, and minimal to no first-step pain. "Fair" was defined as a visual analog scale score of 3 to 5, occasional effect on activities, and occasional first-step pain. "Poor" was defined as a visual analog scale score of more than 5, constant effect on activities, and constant first-step pain.

Davis et al[33] conducted a retrospective study of 105 patients via a follow-up questionnaire to assess long-term results (average follow-up was 29 months) of nonoperative treatment for 132 symptomatic heels. They calculated an 89% success rate with nonoperative treatment that included rest, NSAIDs, stretching exercises for the Achilles tendon and plantar fascia, and heel cushions. They stated that "stretching was rated as the most effective treatment."[33(p533)] Again, however, the patients were not randomly assigned to independent treatment groups, and thus could have received more than one treatment simultaneously.

A generally accepted statement is that the majority of patients improve with conservative therapy, often with a combination of conservative treatment modalities.[13]

In a prospective randomized study, Batt et al[34] determined that a cure had been achieved in 30 of 33 feet treated with a tension night splint in combination with a viscoelastic heel pad, a stretching program, and NSAIDs.

Scherer and the Biomechanics Graduate Research Group for 1988[14] treated 118 painful heels (73 patients) with steroid injections and orthoses. The study showed that within 6 weeks, approximately 84% of the patients had at least 80% relief of symptoms, 10% had partial relief, and 7% had no relief. This study identified a subgroup of patients unable for various reasons to receive NSAIDs or injection therapy. These patients received only taping or orthotic treatment. Of this group, 89% had more than 80% relief of symptoms, 7% had partial relief, and 4% had no relief. The authors concluded that, with or without short-term NSAIDs, mechanical control of the foot is an important factor in the relief of pain from plantar fasciitis.

Most cases of plantar fasciitis resolve with nonsurgical modalities. The approach most physicians take is a combination of the conservative treatments discussed in this article. This combining of treatment modalities has made it difficult to assess the individual effectiveness of each modality in comparison with others.

The present study shows mechanical control of the foot to be the most important nonsurgical treatment modality for plantar fasciitis. The authors randomized patients, with no significant difference in demographic variables, into three different treatment categories to evaluate the individual effectiveness of each type of treatment. Overall, 70% of the patients in the mechanical group had an excellent or fair outcome, significantly better than the 33% and 30% rates for the anti-inflammatory and accommodative groups, respectively. Also, only 4% of the mechanical control group had treatment failure, as opposed to 23% for the anti-inflammatory group and 42% for the accommodative group. The mechanical group had a mean visual analog scale score change over time of 4.4, compared with 3.4 and 2.2 for the anti-inflammatory and accommodative groups, respectively. The final visual analog scale score was also best for the mechanical control group, with 64% achieving a score of 0 to 2, compared with 45% of the anti-inflammatory group and 23% of the accommodative group.

Conclusion

The results of this study show that mechanical control of the foot with taping and orthoses is more effective than either anti-inflammatory therapy with NSAIDs in combination with injections or accommodative therapy with heel cups in the conservative treatment of plantar fasciitis.

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