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Night splints:
Conservative Management of Plantar Fasciitis

We have noted success with patients who have used night splints, but compliance can be a challenge. Use of a night splint with 5 degrees of dorsiflexion was used on fourteen patients. Eleven of the fourteen using the night splint experienced resolution of recalcitrant plantar fasciitis.

by A. Louis Jimenez, DPM, and Robert M. Goecker, DPM

Plantar fasciitis is characterized by pain and inflammation secondary to strain on the intrinsic musculature and plantar fascia at their origin from the calcaneal tubercles. The classic physical examination finding is point tenderness at the anterior edge of the fascial attachment to the medial calcaneal tubercle. This usually coincides with a history of pain on rising in the morning, which subsides during the day but returns after periods of nonweight-bearing. While several potential etiologies of heel pain exist, in our opinion the primary cause lies with abnormalities of pedal biomechanics, leading to increased strain on the tissues that originate from the medial calcaneal tubercle.

Conservative modalities used to treat plantar fasciitis include heel pads, orthoses, padding, strapping, stretching, physical therapy, nonweight-bearing, nonsteroidal anti-inflammatory drugs (NSAIDs), and corticosteroid injections. Even with appropriate treatment, plantar fasciitis may become chronic and recalcitrant, which may eventually lead to surgery. A review of recent literature suggests that posterior night splints are another effective conservative therapy for plantar fasciitis.

Wapner et al first described the use of posterior night splints in the treatment of plantar fasciitis in 1991. In this study, a custom-molded polypropylene ankle-foot orthosis maintaining 5 of dorsiflexion was used as a night splint. The study described resolution of recalcitrant plantar fasciitis in 11 of 14 patients using night splints with traditional treatment protocols in less than four months, with a minimum follow-up of nine months after commencing the use of their splints.

Since Wapner's original paper was published, only two other case studies and one prospective randomized clinical trial have been published on this subject. Batt et al showed success using tension night splints during their clinical trial. The control group who were treated by other conservative measures had success in only six of 17 cases. On the other hand, the randomized night splint group had a 100% response (16 of 16). Patients who were deemed failures in the control group were placed in night splints. The night splints resolved their pain in eight of 11 instances. Therefore, only three cases (of 27) failed treatment using night splints in combination with other conservative modalities. In all of the studies, traditional treatment protocol regimens have continued during the use of the posterior-tension night splints. No study has looked at the efficacy of night splints alone in the treatment of plantar fasciitis. Also, no reported study used any of the prefabricated night splints now available on the market. Instead, they used the original prescription ankle-foot orthosis or an office-made posterior splint held in place with an elastic wrap. Success in these studies has ranged from 80% to 90%.

The therapeutic benefit of night splints revolves around two main principles. First, splinting maintains the length of the plantar fascia while the patient sleeps. Normally, muscle tone within the triceps surae causes the ankle joint to assume a plantar-flexed position while at rest. With the foot in the plantar-flexion position, the plantar fascia and intrinsic plantar

musculature shorten, relax, and adapt overnight to a nonfunctional state. The shortened, tight plantar fascia and intrinsic musculature would explain the phenomenon of poststatic dyskinesia, where the first few steps after long periods of rest are extremely painful. The posterior night splint retains the tension within the plantar fascia and intrinsic musculature, maintaining their functional lengths and decreasing the sudden stress that ambulation places on the plantar aspect of the foot after periods of rest. Splints can be positioned with the foot dorsiflexed 5 to 15 to the leg. In addition, a pad may be added to the anterior aspect of the night splints to maximize the stretching of the plantar fascia and intrinsic musculature.

In 1996, Batt et al suggested that the success of night splints was due to their utilization of the physical property of creep-plastic deformation in response to strain. Night splints provide constant, consistent strain, which not only maintains functional length, but eventually provides a net reduction of stress within the plantar fascia and intrinsic muscles. The reduction of stress occurs as a result of the gains in muscle length achieved because of the laws of soft tissue remodeling.

The second main principle supporting the use of night splints suggests that, over a period of time, night splints stretch the triceps surae and thus decrease tightness in the Achilles tendon. This avoids the many deleterious effects of equinus during the gait cycle.

Pronation secondary to equinus is at the root of chronic heel pain in a large percentage of cases. With equinus, the foot attempts to compensate for the lack of ankle joint dorsiflexion just before heel lift via subtalar and midtarsal joint pronation. During pronatory gait, every step leads to an unstable forefoot because of the unlocking of the midtarsal joint. To compensate for this instability, greater intrinsic muscle activity is required, resulting in excessive stress on the intrinsic muscular origins from the calcaneus inferiorly and particularly the medial tubercle of the calcaneus, leading to inflammation. Pronation also results in abnormal and prolonged eversion of the calcaneus, leading to flattening of the medial longitudinal arch, which increases the strain within the plantar fascia due to the windlass effect. This windlass effect also facilitates supination of the subtalar and oblique axis of the midtarsal joint during propulsion. Continued strain and increased stress to the plantar fascia and intrinsic musculature leads to enthesopathy, radiographically evidenced as an inferior calcaneal spur of varying size.

Many patients will try almost any conservative regimen in an effort to avoid surgery. However, compliance with these splints can be a challenge. Most patients will tolerate them for about two weeks, at which point some patients get uncomfortable and may start removing them at night. Wearing night splints may adversely affect patients' sleeping habits and consequently their lives and work productivity. In these cases, patients often prefer to abandon the splints. However, one advantage of this method of treatment over a full below-the-knee cast is that night splints may be removed intermittently.

Overall, we have noted success with patients who have used night splints. Currently we are using them in the treatment of plantar fasciitis, and postoperatively following endoscopic plantar fasciotomies to maintain the length of the incised plantar fascia. A standard posterior splint and elastic wrap can be employed, but any of several prefabricated night splints now available on the market can be used.

In our experience, the concepts underlying the use of night splints are sound. However, further studies, with larger patient samples and more specific treatment parameters, are still needed to determine whether favorable outcomes can be scientifically supported.

A. Louis Jimenez, DPM, *is president of the American College of Foot and Ankle Surgeons and is in private practice in Snellville and Tucker, GA.* ***Robert M. Goecker, DPM,*** *is a second-year resident at Northlake Regional Medical Center in Tucker, GA.*

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