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Heel Pain—Plantar Fasciitis:

*Clinical Practice Guidelines
 Linked to the International Classification
 of Functioning, Disability, and Health
 from the Orthopaedic Section of the
 American Physical Therapy Association*

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Recommendations*

PATHOANATOMICAL FEATURES: Clinicians should assess for impairments in muscles, tendons, and nerves, as well as the plantar fascia, when a patient presents with heel pain. (Recommendation based on expert opinion.)

RISK FACTORS: Clinicians should consider limited ankle dorsiflexion range of motion and a high body mass index in nonathletic populations as predisposing factors for the development of heel pain/plantar fasciitis. (Recommendation based on moderate evidence.)

DIAGNOSIS/CLASSIFICATION: Pain in the plantar medial heel region; most noticeable with initial steps after a period of inactivity but also worse following prolonged weight bearing; and often precipitated by a recent increase in weight-bearing activity are useful clinical findings for classifying a patient with heel pain into the International Statistical Classification of Diseases and Related Health Problems (ICD) category of plantar fasciitis and the associated International Classification of Functioning, Disability, and Health (ICF) impairment-based category of heel pain (b28015, Pain in lower limb; b2804, Radiating pain in a segment or region).

In addition, the following physical examination measures may be useful in classifying a patient with heel pain into the ICD category of plantar fasciitis and the associated ICF impairment-based category of heel pain. (Recommendation based on moderate evidence.)

- Palpation of the proximal plantar fascia insertion
- Active and passive talocrural joint dorsiflexion range of motion
- The tarsal tunnel syndrome test
- The windlass test
- The longitudinal arch angle

DIFFERENTIAL DIAGNOSIS: Clinicians should consider diagnostic classifications other than heel pain/plantar fasciitis when the patient's reported activity limitations or impairments of body function and structure are not consistent with those presented in the diagnosis/classification section of this guideline, or, when the patient's symptoms are not resolving with interventions aimed at normalization of the patient's physical impairments. (Recommendation based on expert opinion.)

EXAMINATION—OUTCOME MEASURES: Clinicians should use validated self-report questionnaires, such as the Foot Function Index (FFI), Foot Health Status Questionnaire (FHSQ), or the Foot and Ankle Ability Measure (FAAM), before and after interventions intended to alleviate the impairments of body function and structure, activity limitations, and participation restrictions associated with heel pain/plantar fasciitis. Physical therapists should consider measuring change over time using the FAAM as it has been validated in a physical therapy practice setting. (Recommendation based on strong evidence.)

EXAMINATION—ACTIVITY LIMITATION MEASURES: Clinicians should utilize easily reproducible activity limitation and participation restriction measures associated with the patient's heel pain/plantar fasciitis to assess the changes in level of function over the episode of care. (Recommendation based on expert opinion.)

INTERVENTIONS—MODALITIES: Dexamethasone 0.4% or acetic acid 5% delivered via iontophoresis can be used to provide short-term (2 to 4 weeks) pain relief and improved function. (Recommendation based on moderate evidence.)

INTERVENTIONS—MANUAL THERAPY: There is minimal evidence to support the use of manual therapy and nerve mobilization procedures to provide short-term (1 to 3 months) pain relief and improved function. Suggested manual therapy procedures include talocrural joint posterior glide, subtalar joint lateral glide, anterior and posterior glides of the first tarsometatarsal joint, subtalar joint distraction manipulation, soft tissue mobilization near potential nerve entrapment sites, and passive neural mobilization procedures. (Recommendation based on theoretical/foundational evidence.)

INTERVENTIONS—STRETCHING: Calf muscle and/or plantar fascia-specific stretching can be used to provide short-term (2-4 months) pain relief and improvement in calf muscle flexibility. The dosage for calf stretching can be either 3 times a day or 2 times a day utilizing either a sustained (3 minutes) or intermittent (20 seconds) stretching time, as neither dosage produced a better effect. (Recommendation based on moderate evidence.)

INTERVENTIONS—TAPING: Calcaneal or low-Dye taping can be used to provide short-term (7-10 days) pain relief. Studies indicate that taping does cause improvements in function. (Recommendation based on weak evidence.)

INTERVENTIONS—ORTHOTIC DEVICES: Prefabricated or custom foot orthoses can be used to provide short-term (3 months) reduction in pain and improvement in function. There appear to be no differences in the amount of pain reduction or improved function created by custom foot orthoses in comparison to prefabricated orthoses. There is currently no evidence to support the use of prefabricated or custom foot orthoses for long-term (1 year) pain management or function improvement. (Recommendation based on strong evidence.)

INTERVENTIONS—NIGHT SPLINTS: Night splints should be considered as an intervention for patients with symptoms greater than 6 months in duration. The desired length of time for wearing the night splint is 1 to 3 months. The type of night splint used (ie, posterior, anterior, sock-type) does not appear to affect the outcome. (Recommendation based on moderate evidence.)

*These recommendations and clinical practice guidelines are based on the scientific literature published prior to May 2007.

Introduction

AIM OF THE GUIDELINE

The Orthopaedic Section of the American Physical Therapy Association (APTA) has an ongoing effort to create evidence-based practice guidelines for orthopaedic physical therapy management of patients with musculoskeletal impairments described in the World Health Organization's International Classification of Functioning, Disability, and Health (ICF).²²

The purposes of these clinical guidelines are to:

- Describe evidence-based physical therapy practice including diagnosis, prognosis, intervention, and assessment of outcome for musculoskeletal disorders commonly managed by orthopaedic physical therapists
- Classify and define common musculoskeletal conditions using the World Health Organization's terminology related to impairments of body function and body structure, activity limitations, and participation restrictions
- Identify interventions supported by current best evidence to address impairments of body function and structure, activity limitations, and participation restrictions associated with common musculoskeletal conditions
- Identify appropriate outcome measures to assess changes resulting from physical therapy interventions in body function and structure, as well as in activity and participation of the individual

- Provide a description to policy makers, using internationally accepted terminology, of the practice of orthopaedic physical therapists
- Provide information for payers and claims reviewers regarding the practice of orthopaedic physical therapy for common musculoskeletal conditions
- Create a reference publication for orthopaedic physical therapy clinicians, academic instructors, clinical instructors, students, interns, residents, and fellows regarding the best current practice of orthopaedic physical therapy

STATEMENT OF INTENT

This guideline is not intended to be construed or to serve as a standard of medical care. Standards of care are determined on the basis of all clinical data available for an individual patient and are subject to change as scientific knowledge and technology advance and patterns of care evolve. These parameters of practice should be considered guidelines only. Adherence to them will not ensure a successful outcome in every patient, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgment regarding a particular clinical procedure or treatment plan must be made in light of the clinical data presented by the patient and the diagnostic and treatment options available. However, we suggest that significant departures from accepted guidelines should be documented in the patient's medical records at the time the relevant clinical decision is made.

Methods

Content experts were appointed by the Orthopaedic Section, APTA, as developers and authors of clinical practice guidelines for musculoskeletal conditions of the ankle and foot that are commonly treated by physical therapists. These content experts were given the task to identify impairments of body function and structure, activity limitations, and participation restrictions, described using ICF terminology, that could (1) categorize patients into mutually exclusive impairment patterns upon which to base intervention strategies, and (2) serve as measures of changes in function over the course of an episode of care. The second task given to the content experts was to describe interventions and supporting evidence for specific subsets of patients based upon the previously chosen patient categories. It was also acknowledged by the Orthopaedic Section, APTA, that a systematic search and review of the evidence related to

diagnostic categories based on International Statistical Classification of Diseases and Health Related Problems (ICD)²³ terminology would not be useful for these ICF-based clinical practice guidelines, as most of the evidence associated with changes in levels of impairment or function in homogeneous populations is not readily searchable using the current terminology. This approach, although less systematic, enabled the content experts to search the scientific literature related to classification, outcome measures, and intervention strategies for musculoskeletal conditions commonly treated by physical therapists.

This guideline was issued in 2008 based upon publications in the scientific literature prior to May 2007. This guideline will be considered for review in 2012, or sooner if new evidence becomes available. Any updates to the guideline in the interim period will be noted on the Orthopaedic Section, APTA website: www.orthopt.org.

continued

Methods (continued)

LEVELS OF EVIDENCE

Individual clinical research articles were graded according to criteria described by the Center for Evidence-Based Medicine, Oxford, United Kingdom (Table 1 below).

I	Evidence obtained from high-quality randomized controlled trials, prospective studies, or diagnostic studies
II	Evidence obtained from lesser-quality randomized controlled trials, prospective studies, or diagnostic studies (eg, improper randomization, no blinding, > 80% follow-up)
III	Case controlled studies or retrospective studies
IV	Case series
V	Expert opinion

GRADES OF EVIDENCE

The overall strength of the evidence supporting recommendations made in this guideline will be graded according to guidelines described by Sackett¹⁹ as modified by MacDermid and adopted by the coordinator and reviewers of this project. In this modified system, the typical A, B, C, and D grades of evidence have been modified to include the role of consensus expert opinion and basic science research to demonstrate biological or biomechanical plausibility (Table 2 below).

GRADES OF RECOMMENDATION	STRENGTH OF EVIDENCE
A	Strong evidence A preponderance of level I and/or level II studies support the recommendation. This must include at least 1 level I study
B	Moderate evidence A single high-quality randomized controlled trial or a preponderance of level II studies support the recommendation
C	Weak evidence A single level II study or a preponderance of level III and IV studies including statements of consensus by content experts support the recommendation
D	Conflicting evidence Higher-quality studies conducted on this topic disagree with respect to their conclusions. The recommendation is based on these conflicting studies
E	Theoretical/foundational evidence A preponderance of evidence from animal or cadaver studies, from conceptual models/principles, or from basic sciences/bench research support this conclusion
F	Expert opinion Best practice based on the clinical experience of the guidelines development team

REVIEW PROCESS

The Orthopaedic Section, APTA also selected consultants from the following areas to serve as reviewers of the early drafts of this clinical practice guideline:

- Claims review
- Coding
- Epidemiology
- Medical practice guidelines
- Orthopaedic physical therapy residency education
- Physical therapy academic education
- Sports physical therapy residency education

Comments from these reviewers were utilized by the project coordinators to edit this clinical practice guideline prior to submitting it for publication to the *Journal of Orthopaedic & Sports Physical Therapy*.

In addition, several physical therapists practicing in orthopaedic and sports physical therapy settings were sent initial drafts of this clinical practice guideline, along with feedback forms to determine its usefulness, validity, and impact. All returned feedback forms from these practicing clinicians described this clinical practice guideline as:

- “Extremely useful”
- An “accurate representation of the peer-reviewed literature”
- A guideline that will have a “substantial positive impact on orthopaedic physical therapy patient care”

CLASSIFICATION

The primary ICD-10 code and condition associated with heel pain is **M72.2 Plantar fascial fibromatosis/Plantar fasciitis**.²³ Other, secondary ICD-10 codes and conditions associated with heel pain are **G57.5 Tarsal tunnel syndrome** and **G57.6 Lesion of plantar nerve/Morton’s metatarsalgia**.²³ The corresponding ICD-9 CM codes and conditions, which are used in the USA, are 728.71 Plantar fascial fibromatosis/Contracture of plantar fascia, Plantar fasciitis (traumatic), 355.5 Tarsal tunnel syndrome, and 355.6 Lesion of plantar nerve/Morton’s metatarsalgia, neuralgia, or neuroma. The clinical features that differentiate pathology of the plantar fascia, plantar nerves near the proximal plantar fascia, or tissues of the tarsal tunnel, are often overlapping because it is difficult to selectively load the tissues hypothesized to be the source of a patient’s heel pain during physical examination² and treatment procedures.^{11,38}

The primary ICF body function codes associated with plantar fasciitis, tarsal tunnel syndrome, and plantar nerve lesions are the sensory functions related to pain. These body function codes are **b28015 Pain in lower limb** and **b2804 Radiating pain in a segment or region**.

The primary ICF body structure codes associated with plantar fasciitis are **s75023 Ligaments and fasciae of ankle and foot** and **s75028 Structures of ankle and foot, neural**.

The primary ICF activities and participation codes associated with plantar fasciitis are **d4500 Walking short distances**, **d4501 Walking long distances**, and **d4154 Maintaining a standing position**.

The primary and secondary ICD-10 and ICF codes associated with heel pain are provided in Table 3 on the facing page.

ICD-10 and ICF Codes Associated With Heel Pain

INTERNATIONAL STATISTICAL CLASSIFICATION OF DISEASES AND RELATED HEALTH PROBLEMS

Primary ICD-10	M72.2	Plantar fascial fibromatosis Plantar fasciitis
Secondary ICD-10	G57.5 G57.6	Tarsal tunnel syndrome Lesion of plantar nerve

INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY, AND HEALTH

PRIMARY ICF CODES

Body functions	b28015	Pain in lower limb
	b2804	Radiating pain in a segment or region
Body structure	s75023	Ligaments and fascia of ankle and foot
	s75028	Structures of ankle and foot, neural
Activities and participation	d4500	Walking short distances
	d4501	Walking long distances
	d4154	Maintaining a standing position

SECONDARY ICF CODES

Body functions	b7100	Mobility of a single joint (increase or decrease in mobility)
	b7101	Mobility of several joints (increase or decrease in mobility)
	b7203	Mobility of tarsal bones (increase or decrease in mobility)
	b7300	Power of isolated muscles and muscle groups (weakness of intrinsics)
	b7401	Endurance of muscle groups
	b770	Gait pattern functions (antalgic gait)
Body structure	s75020	Bones of ankle and foot (calcaneus/heel spur)
	s75022	Muscles of ankle and feet (extensor digitorum brevis, abductor hallucis, abductor digiti quinti, gastrocnemius/soleus)
	s75028	Structure of ankle and foot, specified as tarsal tunnel/flexor retinaculum
	s198	Structure of the nervous system, specified as tibial nerve and branches
Activities and participation	d4101	Squatting
	d4104	Standing
	d4106	Shifting the body's centre of gravity
	d4302	Carrying in arms (object)
	d4303	Carrying on shoulders, hip, and back
	d4350	Pushing with lower extremities
	d4351	Kicking
	d4502	Walking on different slopes
	d4503	Walking around obstacles
	d4551	Climbing
	d4552	Running
	d4553	Jumping
	d4600	Moving around within the home
	d4601	Moving around within buildings other than home
	d4602	Moving around outside the home or other buildings

CLINICAL GUIDELINES

Impairment-/Function-based Diagnosis

PREVALENCE

PLANTAR FASCIITIS IS THE MOST COMMON FOOT CONDITION treated by healthcare providers. It has been estimated that plantar fasciitis occurs in approximately 2 million Americans each year and affects as much as 10% of the population over the course of a lifetime.⁴⁸ In 2000 the Foot and Ankle Special Interest Group of the Orthopaedic Section, APTA, surveyed over 500 members and received responses from 117 therapists.⁴⁷ Of those responding, 100% indicated that plantar fasciitis was the most common foot condition seen in their clinic.⁴⁷ Rome et al⁴⁹ reported that plantar fasciitis accounts for 15% of all adult foot complaints requiring professional care and is prevalent in both nonathletic and athletic populations. Taunton et al⁵⁴ conducted a retrospective case-control analysis of 2002 individuals with running-related injuries who were referred to the same sports medicine center. They reported that plantar fasciitis was the most common condition diagnosed in the foot and represented 8% of all injuries.

PATHOANATOMICAL FEATURES

THE PLANTAR APONEUROSIS OR FASCIA CONSISTS OF 3 BANDS: lateral, medial, and central. It is the central band that originates from the medial tubercle on the plantar surface of the calcaneus and that travels toward the toes as a solid band of tissue dividing just prior to the metatarsal heads into 5 slips. Each slip then divides in half to insert on the proximal phalanx of each toe. As a result of the central band only attaching to the calcaneus and the proximal phalanx of each toe, when the toes are extended, the plantar fascia is functionally shortened as it wraps around each metatarsal head. Hicks²⁰ was the first to describe this functional shortening as the “windlass effect” of the plantar fascia. The windlass effect can assist in supinating the foot during the latter portion of the stance phase.

III The following intrinsic muscles of the foot have the same insertion as the central band of the plantar fascia: flexor digitorum brevis, abductor hallucis, and the medial head of the quadratus plantae. Medial calcaneal branches from the tibial nerve innervate the plantar heel pad. The tibial nerve divides into the medial and lateral plan-

tar nerves while traveling through the tarsal tunnel. Both the medial plantar, lateral plantar, and their respective nerve branches can be subject to entrapment leading to “tarsal tunnel syndrome.” This includes a second branch of the lateral plantar nerve, also referred to as “Baxter’s nerve,” which can also be entrapped.¹⁷ There appears to be an anatomical connection between the Achilles tendon and the plantar aponeurosis. Snow et al⁵¹ reported an anatomical continuity of the fibers between the Achilles tendon and the plantar fascia in the feet of cadavers. They noted that there was a continuous diminution of the number of fibers connecting the Achilles tendons and plantar fascia as the foot aged.

The most common site of abnormality in individuals complaining of heel pain diagnosed as plantar fasciitis is near the origin or entheses of the central band of the plantar aponeurosis at the medial plantar tubercle of the calcaneus. On occasion, individuals will complain of pain and symptoms in the mid-portion of the central band, just prior to it splitting into the 5 slips.

Plantar fasciitis occurs as an enthesopathy in patients with a seronegative arthropathy. Generally symptoms are present bilaterally in these cases. In systemic rheumatic diseases, enthesitis (insertitis) can occur as a result of endogenous, unknown causes.¹⁶ Plantar fascia insertitis can be associated with Reiter’s syndrome, psoriatic arthropathy, ankylosing spondylitis, and enteropathic spondyloarthropathy.^{30,56}

F

Clinicians should assess for impairments in muscles, tendons, and nerves, as well as the plantar fascia, when a patient presents with heel pain.

RISK FACTORS

II

THE SPECIFIC CAUSE OF PLANTAR FASCIITIS IS POORLY understood and is multifactorial. Riddle et al⁴⁸ determined risk factors for plantar fasciitis in a nonathletic population using a matched case-control design with 2 controls for each patient. A total of 50 patients with unilateral plantar fasciitis met the inclusion criteria. The authors concluded that the risk of plantar fasciitis increased as ankle dorsiflexion range of motion decreased. Other factors

that increased the risk of developing plantar fasciitis in this study population were spending the majority of the workday on the feet and a body-mass index of greater than 30 kg/m². While ankle dorsiflexion, obesity, and work-related weight bearing were reported to be independent risk factors, reduced ankle dorsiflexion appeared to be the most important.⁴⁸

II In a recent systematic review examining risk factors associated with chronic plantar heel pain, Irving et al²⁴ reported a strong association between a body-mass index of 25 to 30 kg/m² and a calcaneal spur in a non-athletic population. They reported a weak association for the development of plantar fasciitis with increased body-mass index in an athletic population, increased age, decreased ankle dorsiflexion, decreased first metatarsophalangeal joint extension, and prolonged standing. Irving and colleagues²⁴ noted that the relationship between static foot posture as well as dynamic foot motion and the development of plantar fasciitis was inconclusive.

II The findings of Irving et al²⁴ with regard to static foot posture and dynamic foot motion are of interest because the high incidence of plantar fasciitis in runners has been anecdotally attributed to repetitive micro-trauma associated with excessive pronation. Messier and Pitala³⁷ as well as Wearing et al⁵⁸ have assessed dynamic foot motion retrospectively in both runners and walkers with plantar fasciitis. Both studies reported no differences between case and control groups, but the sample size evaluated in these studies were small.

B Clinicians should consider limited ankle dorsiflexion range of motion and a high body-mass index in nonathletic populations as factors predisposing patients to the development of heel pain/plantar fasciitis.

CLINICAL COURSE

BASED ON LONG-TERM FOLLOW-UP DATA IN CASE SERIES comprised primarily of patients seen in an orthopaedic outpatient setting, the clinical course for most patients was positive, with 80% reporting resolution of symptoms within a 12-month period.^{34,60}

DIAGNOSIS/CLASSIFICATION

II THE DIAGNOSIS OF PLANTAR FASCIITIS IS MADE with a reasonable level of certainty on the basis of a clinical assessment alone.^{4,5,8,10}

- Patients typically report an insidious onset of pain under the plantar surface of the heel upon weight bearing after a period of non-weight bearing.
- This pain in the plantar heel region is most noticeable in

the morning with the first steps after waking or after a period of inactivity.

- In some cases, the pain is so severe that it results in an antalgic gait.
- The patient will usually report that the heel pain will lessen with increasing levels of activity (ie, walking, running), but will tend to worsen toward the end of the day.
- The history usually indicates that there has been a recent change in activity level, such as increased distance with walking or running, or an employment change that requires more time standing or walking.
- In most cases the patient will initially complain of sharp, localized pain under the anteromedial aspect of the plantar surface of the heel, with paresthesias being uncommon.

B Pain in the plantar medial heel region; most noticeable with initial steps after a period of inactivity but also worse following prolonged weight bearing; and often precipitated by a recent increase in weight bearing activity are useful clinical findings for classifying a patient with heel pain into the ICD category of plantar fasciitis and the associated ICF impairment-based category of heel pain (b28015 Pain in lower limb; b2804 Radiating pain in a segment or region).

In addition, the following physical examination measures may be useful in classifying a patient with heel pain into the ICD category of plantar fasciitis and the associated ICF impairment-based category of heel pain (b28015 Pain in lower limb; b2804 Radiating pain in a segment or region).

- Palpation of the proximal plantar fascia insertion
- Active and passive talocrural joint dorsiflexion range of motion
- The tarsal tunnel syndrome test
- The windlass test
- The longitudinal arch angle

DIFFERENTIAL DIAGNOSIS

The following differential diagnoses have been suggested for plantar heel pain^{4,8}:

- Calcaneal stress fracture
- Bone bruise
- Fat pad atrophy
- Tarsal tunnel syndrome
- Soft-tissue, primary, or metastatic bone tumors
- Paget disease of bone
- Sever's disease
- Referred pain as a result of an S1 radiculopathy

F Clinicians should consider diagnostic classifications other than heel pain/plantar fasciitis when the patient's reported activity limitations or impairments of body function and structure are not consistent with those presented in the diagnosis/classification section of this guideline, or, when the patient's symptoms are not resolving with interventions aimed at normalization of the patient's impairments of body function.

IMAGING STUDIES

Imaging studies are typically not necessary for the diagnosis of plantar fasciitis.^{8,39} Imaging would appear to be most useful to rule out other possible causes of heel pain or to establish a diagnosis of plantar fasciitis if the healthcare provider is

in doubt.⁸ In a recent study, Osborne et al⁴¹ utilized lateral radiographs to assess radiographic changes in 27 patients diagnosed with plantar fasciitis in comparison to 79 controls. A single blinded examiner evaluated the plain non-weight-bearing films. Calcaneal spurs were observed in 85% of the individuals with plantar fasciitis and in 46% of those in the control group. Plantar fascia thickness and fat pad abnormalities were the 2 best factors for group differentiation of plantar fasciitis, with a sensitivity of 85% and a specificity of 95%. These authors concluded that calcaneal spurs were not a key radiographic feature to distinguish differences between the 2 groups and that a lateral non-weight-bearing radiograph to assess soft tissue changes should be the first choice if imaging is desired.⁴¹

CLINICAL GUIDELINES

Examination

OUTCOME MEASURES

I WHILE THE MAJORITY OF THE STUDIES REVIEWED for this guideline have utilized the Foot Function Index (FFI), Foot Health Status Questionnaire (FHSQ), or the Foot and Ankle Ability Measure (FAAM) as functional outcome questionnaires, only the FAAM has been validated in a physical therapy practice setting.³³ The FAAM consists of a 21-item activities of daily living (ADL) and an 8-item sports subscale. Martin et al³³ validated the FAAM for test content, internal structure, score stability, as well as responsiveness using 151 patients for the ADL subscale and 130 patients for the sports subscale over a 4-week treatment period. The test-retest reliability was 0.89 and 0.87 for the ADL and sports subscales, respectively. Martin et al³³ reported that the minimally clinically important differences for the FAAM were 8 points for the ADL subscale and 9 points for the sports subscale.

A Clinicians should use validated self-report questionnaires, such as the FFI, FHSQ, or FAAM, before and after interventions intended to alleviate the impairments of body function and structure, activity limitations, and participation restrictions associated with heel pain/plantar fasciitis. Physical therapists should consider measuring change over time using the FAAM as it has been validated in a physical therapy practice setting.

ACTIVITY LIMITATION MEASURES

V THERE ARE NO ACTIVITY LIMITATION MEASURES specifically reported in the literature associated with heel pain/plantar fasciitis—other than those that are part of the self-report questionnaires noted in this guideline's Outcome Measures section. However, the following measures are options that a clinician may use to assess changes in a patient's level of function over an episode of care.

- Percent of time experiencing ankle, foot, or heel pain over the previous 24 hours
- Pain level with initial steps after sitting or lying
- Pain level with single-leg stance
- Pain level with standing for a specified period of time, such as 30 minutes
- Pain level after walking a specified distance, such as 1000 m

In addition, the Patient-Specific Functional Scale is a questionnaire that can be used to quantify changes in activity limitations and level of participation for patients with heel pain.⁵³ This scale enables the clinician to collect measures related to function that may be different than the measures that are components of the self-report questionnaires noted in the Outcome Measures section of this guideline.

F Clinicians should utilize easily reproducible activity limitation and participation restriction measures associated with their patient's heel pain/plantar fasciitis to assess the changes in the patient's level of function over the episode of care.

PHYSICAL IMPAIRMENT MEASURES

ACTIVE AND PASSIVE ANKLE DORSIFLEXION	
ICF category	Measurement of impairment of body function: mobility of a single joint
Description	The amount of active ankle dorsiflexion range of motion measured with the knee extended
Measurement method	The patient is positioned in prone with feet over the edge of the treatment table. The examiner asks the patient to dorsiflex the ankle for an active measurement, or the examiner passively dorsiflexes the ankle, while ensuring that the foot does not evert or invert during the dorsiflexion maneuver. At the end of the active or passive dorsiflexion range of motion, the examiner aligns the stationary arm of the goniometer along the shaft of the fibula and aligns the moving arm of the goniometer along the shaft of the 5th metatarsal.
Nature of variable	Continuous
Units of measurement	Degrees
Measurement properties	There is ample evidence to support the intrarater reliability of dorsiflexion range of motion measurements (reported intraclass correlation coefficient (ICC) for active assessment varies from 0.64 to 0.92; ICC for passive assessment varies from 0.74 to 0.98). There is some evidence to support interrater reliability with reported ICC varying from 0.29 to 0.81. ³⁵

THE DORSIFLEXION-EVERSION TEST FOR DIAGNOSIS OF TARSAL TUNNEL SYNDROME			
ICF category	Measurement of impairment of structure of the nervous system, other specified		
Description	In non-weight bearing, dorsiflexion of the ankle, eversion of the foot, and extension of all of the toes is maintained for 5 to 10 seconds to determine if the patient's symptoms are elicited		
Measurement method	With the patient sitting, the examiner maximally dorsiflexes the ankle, everts the foot, and extends the toes maintaining the position for 5 to 10 seconds, while tapping over the region of the tarsal tunnel to determine if a positive Tinel sign is present or if the patient complains of local nerve tenderness.		
Nature of variable	Nominal		
Units of measurement	None		
Measurement properties	Kinoshita et al ²⁵ performed this test on 50 normal and on 37 patients (44 feet) treated operatively for tarsal tunnel syndrome. In the normal group no signs or symptoms were produced by the test. In the 44 symptomatic feet, the test increased numbness or pain in 36 feet and the Tinel sign became more pronounced in 41 feet.		
Diagnostic accuracy indices for increased numbness, based on the study by Kinoshita et al*	95% Confidence Interval		
	Sensitivity	0.81	0.67 - 0.90
	Specificity	0.99	0.91 - 1.00
	Positive likelihood ratio	82.73	5.22 - 1309.51
	Negative likelihood ratio	0.19	0.10 - 0.35
Diagnostic accuracy indices for more pronounced Tinel sign, based on the study by Kinoshita et al*	95% Confidence Interval		
	Sensitivity	0.92	0.81 - 0.97
	Specificity	0.99	0.91 - 0.99
	Positive likelihood ratio	84.07	5.96 - 485.48
	Negative likelihood ratio	0.08	0.03 - 0.22
Cadaver model	In 6 cadavers, Alshami et al ² reported that dorsiflexion-eversion of the ankle combined with extension of the metatarsophalangeal joints significantly increased strain in the tibial nerve, lateral plantar nerve, and medial plantar nerve. However, this maneuver also significantly increased strain in the plantar fascia. During this investigation, both components (dorsiflexion-eversion and metatarsophalangeal joint extension) resulted in significant strain increases. This maneuver also resulted in significant excursion of the tibial (6.9 mm, $P = .016$) and lateral plantar (2.2 mm, $P = .032$) nerves in the distal direction.		

*Using Altman's convention for diagnostic studies with a zero count in the 2-by-2 contingency table (adding 0.5 to all 4 cells) ⁴

WINDLASS TEST

ICF category	Measurement of impairment of body structure: fascia and ligaments of the foot		
Description	Extension of the first metatarsophalangeal joint in both weight bearing and non-weight bearing to cause the windlass effect of the plantar fascia and determine if the patient's heel pain is reproduced		
Measurement method	<p>The test is performed in 2 positions: non-weight bearing and weight bearing.</p> <p>NON-WEIGHT BEARING: With the patient sitting, the examiner stabilizes the ankle joint in neutral with 1 hand placed just behind the first metatarsal head. The examiner then extends the first metatarsophalangeal joint, while allowing the interphalangeal joint to flex. Passive extension (ie, dorsiflexion) of the first metatarsophalangeal joint is continued to its end of range or until the patient's pain is reproduced.</p> <p>WEIGHT BEARING: The patient stands on a step stool and positions the metatarsal heads of the foot to be tested just over the edge of the step. The subject is instructed to place equal weight on both feet. The examiner then passively extends the first metatarsophalangeal joint while allowing the interphalangeal joint to flex. Passive extension (ie, dorsiflexion) of the first metatarsophalangeal joint is continued to its end of range or until the patient's pain is reproduced.</p>		
Nature of variable	Nominal		
Units of measurement	None		
Measurement properties	De Garceau et al ¹³ performed the test on 22 patients with plantar fasciitis and 43 other patients who served as a control group. None of the patients in the other foot pain or control groups reported pain or symptoms in either weight bearing or non-weight bearing. Seven (31.8%) of the 22 patients with plantar fasciitis had pain during the weight-bearing test, while only 3 had pain during the non-weight-bearing test. While the Windlass test had a high specificity (100%), the sensitivity of the test was poor (< 32%) for both the weight-bearing and non-weight-bearing tests		
Diagnostic accuracy indices for the weight-bearing test, based on the study by De Garceau et al*	95% Confidence Interval		
	Sensitivity	0.33	0.17 - 0.53
	Specificity	0.99	0.91 - 1.00
	Positive likelihood ratio	28.70	1.71 - 480.43
	Negative likelihood ratio	0.68	0.51 - 0.91
Diagnostic accuracy indices for the non-weight-bearing test, based on the study by De Garceau et al*	95% Confidence Interval		
	Sensitivity	0.18	0.07 - 0.40
	Specificity	0.99	0.91 - 1.00
	Positive likelihood ratio	16.21	0.88 - 298.75
	Negative likelihood ratio	0.83	0.67 - 1.02
Cadaver model	In 6 cadavers, Alshami et al ² reported that extension of all metatarsophalangeal joints significantly increased strain in the plantar fascia (+0.4%, $P = .016$). However, this maneuver also significantly increased strain in the tibial nerve (+0.4%, $P = .016$).		

*Using Altman's convention for diagnostic studies with a zero count in the 2-by-2 contingency table (adding 0.5 to all 4 cells) *

LONGITUDINAL ARCH ANGLE

ICF category	Measurement of impairment of body function: mobility of a multiple joints		
Description	The angle formed by 1 line projected from the midpoint of the medial malleolus to the navicular tuberosity in relation to a second line projected from the most medial prominence of the first metatarsal head to the navicular tuberosity		
Measurement method	With the patient standing with equal weight on both feet, the midpoint of the medial malleolus, the navicular tuberosity, and the most medial prominence of the first metatarsal head are identified using palpation and marked with a pen. A goniometer is then used to measure the angle formed by the 3 points with the navicular tuberosity acting as the axis point.		
Nature of variable	Continuous		
Units of measurement	Degrees		
Measurement properties	McPoil and Cornwall ³⁶ reported that the longitudinal arch angle (LAA), a static measure of foot posture, was highly predictive of dynamic foot posture during walking. In their study, digital photographs of the medial aspect of both feet for 50 subjects were recorded and used to calculate the LAA. These authors also reported that the LAA demonstrated acceptable intra and interrater reliability. To date, the LAA has only been shown to serve as an accurate threshold for determining the level of risk for developing medial tibial stress syndrome. ⁵² The LAA provides a measure of foot structure and function that could be related to the development of plantar fasciitis.		

CLINICAL GUIDELINES

Interventions

Numerous interventions have been described for the treatment of plantar fasciitis, but few high-quality randomized, controlled trials have been conducted to support these therapies.¹²

ANTI-INFLAMMATORY AGENTS

ALTHOUGH ANTI-INFLAMMATORY AGENTS, INCLUDING NON-steroidal anti-inflammatory drugs (NSAIDs) and steroid injections, are not commonly within the purview of physical therapist practice, patients often seek advice from their therapist as to whether or not they should utilize anti-inflammatory agents in the management of plantar fasciitis. While healthcare providers often prescribe NSAIDs for patients with plantar fasciitis, randomized clinical trials evaluating the use of NSAIDs in isolation have not been conducted.

There is limited evidence to support the use of steroid injection to provide short-term pain relief.¹² A major concern with steroid injection has been the risk of subsequent plantar fascia rupture and plantar fat pad degeneration. Acevedo and Beskin¹ in a retrospective review of 765 patients diagnosed with plantar fasciitis reported that of the 122 patients who had received a steroid injection, 44 patients (36%) had a fascial rupture as a result of the injection. Of even greater importance was the fact that 50% of the patients who suffered a rupture reported only a fair or poor recovery at a 27-month follow-up.¹

More recent studies have reported minimal to no risk for fascia rupture following a steroid injection. Genc et al¹⁵ performed a palpation-guided steroid injection to 47 heels of 30 patients with plantar fasciitis and assessed outcome using ultrasound examination as well as pain intensity at 1 and 6 months postinjection. Thirty healthy individuals served as a control population for the ultrasound examination. They reported that while the initial ultrasound examination demonstrated a significantly thicker plantar fascia in the patient group in comparison to the controls, the thickness of the fascia and pain levels were significantly decreased 1 month after injection. A further decrease in fascial thickness in the patient group was also noted at the 6-month follow-up. They also noted that gross fascia disruption or other side-effects were not observed after steroid injection.¹⁵

Tsai et al⁵⁵ assessed both palpation-guided (n = 13) and ultrasound-guided (n = 12) steroid injection in the heels of 25

patients diagnosed with plantar fasciitis. They assessed the outcome prior to injection and at 2 weeks, 2 months, and 1 year postinjection using an algometer to assess tenderness at the painful site and pain using a visual analog scale. Both tenderness and pain scale scores were significantly improved in both groups 2 weeks after injection. The rate of recurrence of plantar fasciitis, however, was significantly higher in the palpation-guided group (6/13) in comparison to the ultrasound-guided group (1/12).⁵⁵

MODALITIES

II GUEDEMAN ET AL¹⁸ PERFORMED A DOUBLE-BLINDED, placebo controlled study in which 39 subjects (44 feet) were assigned to 1 of 2 treatment groups. Although 4 feet were eliminated for various reasons, 20 feet were assigned to the placebo group, which had iontophoresis electrodes attached to the feet with only phosphate buffered saline administered. The 20 feet in the treatment group received iontophoresis with 0.4% dexamethasone sodium phosphate USP. Both groups also received 6 sessions of physical therapy in addition to the iontophoresis over a 2- to 3-week period, which consisted of ice, plantar fascia and calf muscle stretching, and the use of viscoelastic heel orthoses. The Maryland Foot Score was used to assess treatment outcome in relation to pain and functional changes pretreatment, after the 6 treatments, and at 1 month posttreatment. The group receiving iontophoresis had significantly greater improvement between pretreatment and after 6 treatments in comparison to the placebo group. At 1 month posttreatment there were no differences in pain or function between the 2 groups. The authors concluded that because the use of iontophoresis did not have an effect on long-term pain or function, this modality should be considered for those patients who need an immediate reduction in pain symptoms.¹⁸

II In a more recent study, Osborne and Allison⁴⁰ conducted a double-blinded, randomized, controlled trial that assigned 31 patients diagnosed with plantar fasciitis into 1 of 3 treatment groups: a placebo using 0.9% sodium chloride (10 subjects), iontophoresis with 0.4% dexamethasone (11 subjects), and iontophoresis with 5% acetic acid (10 subjects). Each patient received 6 treatment sessions over 2 weeks and was continuously taped using a low-Dye method throughout the 2-week period. Patients were also instructed to perform calf stretching. Pain and stiff-

ness were independently assessed using a visual analogue scale prior to starting treatment, at the conclusion of 2 weeks of treatment, and 2 weeks following the conclusion of the treatment. The results indicated that both acetic acid and dexamethasone, when delivered via iontophoresis in combination with low-Dye taping, provided good short-term relief of pain and function. Acetic acid produced greater improvements in morning pain than dexamethasone, but continued relief of pain during the 2-week posttreatment period was only observed in the dexamethasone group.⁴⁰

B

Dexamethasone 0.4% or acetic acid 5% delivered via iontophoresis can be used to provide short-term (2 to 4 weeks) pain relief and improved function.

MANUAL THERAPY

IV

THERE IS LIMITED EVIDENCE TO SUPPORT THE USE of manual therapy as an intervention for plantar fasciitis. Young et al⁶¹ reported on 4 patients referred to physical therapy for plantar fasciitis or unilateral plantar heel pain. The duration of symptoms for the 4 patients ranged from 6 to 52 weeks. The authors used a pain rating scale and a self-reported function scale to assess outcome over a period of 1 to 3 months. All 4 patients received manual therapy and stretching. Two patients were also prescribed foot orthoses and another patient received additional strengthening exercises. The manual therapy techniques utilized in this case series included talocrural joint posterior glides, subtalar joint lateral glides, anterior/posterior glides of the first tarsometatarsal joint, and subtalar joint distraction manipulations. All 4 patients in this case series reported a rapid improvement in pain and function as a result of the interventions utilized. Meyer et al³⁸ reported on 1 patient referred to physical therapy for plantar fasciitis with an 8-month history of subcalcaneal heel pain that limited standing and walking. This patient's heel pain was reproduced with the straight-leg raising (SLR) test in combination with ankle dorsiflexion and eversion to sensitize the tibial nerve, suggesting that there was a neurogenic component to this patient's heel pain. The examination findings of this patient appear consistent with the findings of Coppeters and associates¹¹ who reported significant strain and excursion of the tibial nerve in 8 embalmed cadavers when ankle dorsiflexion is combined with the SLR test. This patient with heel pain described by Meyer et al³⁸ received passive and active mobilization aimed at restoring pain-free soft tissue mobility along the course of the median nerve. The passive neural mobilization procedures were performed with the patient in the slump sitting position. Because restricted ankle dorsiflexion, excessive pronation, and posterior tibialis weakness were also found, low-Dye taping and therapeutic exercises were utilized to control excessive pronation and reduce stress on the

plantar fascia. Following 10 treatment sessions over a period of 1 month, this patient's heel pain resolved and his standing and walking tolerance were fully restored. Although case series provide a low level of evidence, the findings of Young et al⁶¹ and Meyer et al³⁸ provide the foundation for future randomized, controlled clinical trials to assess the effectiveness of manual therapy as an intervention for plantar fasciitis.

E

There is minimal evidence to support the use of manual therapy and nerve mobilization procedures to provide short-term (1 to 3 months) pain relief and improved function. Suggested manual therapy procedures include: talocrural joint posterior glide, subtalar joint lateral glide, anterior and posterior glides of the first tarsometatarsal joint, subtalar joint distraction manipulation, soft tissue mobilization near potential nerve entrapment sites, and passive neural mobilization procedures.

STRETCHING

NUMEROUS AUTHORS HAVE RECOMMENDED THAT CALF stretching should be one of the interventions incorporated into the management program for patients with plantar fasciitis.^{18,39,40,42,45} The continuity of connective tissue between the Achilles tendon and the plantar fascia, as well as the fact that decreased ankle dorsiflexion is a risk factor in the development of plantar fasciitis, provides some justification for calf stretching.

II

Porter et al⁴³ conducted a prospective, randomized, blinded study to assess the duration and frequency of calf stretching on improvement in ankle dorsiflexion range of motion and patient outcome as determined using the American Academy of Orthopaedic Surgeon's Lower Limb and Foot and Ankle Modules. Participants included 54 patients with plantar fasciitis who performed a sustained stretch, 40 patients with plantar fasciitis who performed an intermittent stretch, and 41 healthy individuals who served as controls. Participants were instructed to stretch their calf muscles standing at the edge of a step with the heel hanging off the edge while keeping the knee straight and the foot in a neutral position (no abduction or adduction). The individuals in the sustained stretch group stretched for 3 minutes at a time, 3 times a day. Those in the intermittent stretch group stretched for five 20-second intervals, twice daily. Participants in both the sustained and intermittent stretch groups had ankle dorsiflexion range of motion and functional outcomes assessed prior to starting treatment and once a month for 4 consecutive months. Participants in the study were provided with no other treatment interventions. At the end of 4 months, 40 patients remained in the sustained-stretch group and 26 patients remained in the intermittent-stretch group. The results indicated that while there were no differences in outcome between the 2 stretching groups, both groups had

similar increases in ankle dorsiflexion. Furthermore, the increase in ankle dorsiflexion correlated with a decrease in pain for both groups.⁴³

III DiGiovanni¹⁴ et al conducted a prospective, randomized study to determine if a plantar fascia-specific stretch would be more effective than calf stretching. These authors hypothesized that a plantar fascia-specific stretch might have a greater amount of patient compliance as well as a greater improvement in functional outcomes. One hundred one participants were initially assigned to 2 groups: calf stretching (n = 50) and plantar fascia-specific stretching (n = 51). Both groups received over-the-counter soft insoles, a 3-week course of NSAIDs, and patient education regarding plantar fasciitis. The plantar fascia tissue-specific stretch was performed in sitting, with the patient placing the fingers of one hand across the toes of the involved foot, then pulling the toes back (extension) toward the shin until stretching was felt in the arch of the foot. To confirm that they were stretching the fascia, patients were instructed to use the opposite hand to palpate the tension of the fascia on the bottom of the foot. The calf-stretching group was instructed to perform the stretch in standing while leaning into the wall with the nonaffected foot behind the leg being stretched. Patients in the calf-stretching group were asked to stand on their orthotics while stretching, in a slightly toe-in stance. Both groups were instructed to hold each stretch for a count of 10, repeat the stretch 10 times, and perform the stretch 3 times per day. Of the initial 101 patients, heel pain was either eliminated or much improved at 8 weeks in 24 (52%) of the 46 patients who performed the plantar fascia specific stretch, as compared to 8 (22%) out of 36 patients who performed calf stretching. It is important to note, however, that this study was not blinded, a large percentage of patients dropped out of the study (28% calf stretching, 10% plantar fascia stretch), and only the data for those patients who completed the 8-week trial were analyzed.¹⁴

B Calf muscle and/or plantar fascia-specific stretching can be used to provide short-term (2 to 4 months) pain relief and improvement in calf muscle flexibility. The dosage for calf stretching can be either 3 times a day or 2 times a day utilizing either a sustained (3 minutes) or intermittent (20 seconds) stretching time, as neither dosage produced a better effect.

TAPING

ADHESIVE STRAPPING APPEARS TO PROVIDE SHORT-TERM relief of pain in patients with a clinical diagnosis of plantar fasciitis. As previously noted in the discussion on modalities, Osborne and Allison⁴⁰ reported that ionto-

phoresis combined with low-Dye taping provided relief of pain and stiffness when assessed 4 weeks posttreatment.

III Hyland et al²¹ conducted a prospective, randomized, controlled trial to determine the effect of calcaneal taping in comparison to sham taping and stretching. Forty-one patients with a clinical diagnosis of plantar fasciitis were assigned to 4 groups: calcaneal taping (n = 11), sham taping (n = 10), stretching only (n = 10), and a control (n = 10). The stretching group was given both calf stretching and plantar fascia-specific stretching exercises. The calcaneal taping procedure was designed to invert the calcaneus, thus to improve biomechanical position. Patient outcome was assessed using a visual analogue scale for pain and a patient-specific function scale (PSFS) prior to treatment and after 1 week of treatment. While stretching and sham taping decreased pain, calcaneal taping demonstrated a significantly greater decrease in pain than either stretching or sham taping. No differences with regard to function were found among the 4 groups, although calcaneal taping did have the greatest pretest versus posttest difference. Unfortunately, this study was not blinded, had a small number of subjects assigned to each group, and only provided a 1-week follow-up.²¹

III Radford et al⁴⁶ performed a participant-blinded, randomized trial to determine the effectiveness of low-Dye taping for pain and improvement of function in patients with plantar fasciitis. A sample size of 92 patients was divided into 2 equal groups of 46: 1 group receiving low-Dye taping with sham ultrasound and the other group receiving sham ultrasound only. Outcome measures included first-step pain, assessed using a visual analogue scale, as well as the change in foot pain, foot function, and general foot health as determined using the Foot Health Status Questionnaire (FHSQ). Outcome was assessed prior to the initiation of treatment and after 1-week. Participants in the taping group had their foot taped for a median of 7 days (range 3 to 9 days). Similar to the findings reported by Hyland et al,²¹ the low-Dye tape group reported a small but significant difference in first-step pain in comparison to the sham group. No significant differences in FHSQ scores were found between the 2 groups; however, limitations of this study include no control group and short-term follow-up of outcome measures.⁴⁶

C Calcaneal or low-Dye taping can be used to provide short-term (7 to 10 days) pain relief. Studies indicate that taping does cause improvements in function.

ORTHOTIC DEVICES

FOOT ORTHOSES ARE FREQUENTLY UTILIZED AS A COMPONENT of the conservative management plan for plantar fasciitis. The

justification given for the use of foot orthoses is to decrease abnormal foot pronation that is thought to cause increased stress on the medial band of the plantar fascia. To date, evidence that establishes an association between plantar fasciitis and foot motion is inconclusive.²⁴ Studies conducted using cadaver specimens suggest that foot orthoses can reduce the strain in the plantar fascia during static loading, reduce the collapse of the medial longitudinal arch, and reduce elongation of the foot associated with pronation.^{26,27,28}

Seven randomized, controlled clinical trials have been conducted to determine the effectiveness of foot orthoses for the treatment of plantar fasciitis. Two of these studies evaluated the effect of magnetic insoles on plantar heel pain.^{9,59} Both studies concluded that magnets do not provide an additional benefit compared to nonmagnetic insoles for the treatment of plantar heel pain.

II The remaining 5 studies focused on comparing various types of foot orthoses including customized, prefabricated, felt arch pads, and heel cups or pads. Lynch et al³¹ compared the effectiveness of 3 types of conservative therapy for the management of plantar fasciitis. A total of 103 subjects were assigned to 1 of 3 treatment groups: anti-inflammatory therapy consisting of a corticosteroid injection and NSAIDs (n = 35), an accommodative viscoelastic heel cup (n = 33), and a mechanical treatment which consisted of an initial low-Dye taping followed by custom orthoses (n = 35). The primary outcome measure was pain rating based on a visual analogue scale and patients were followed for 3 months. The authors reported that the mechanical treatment group had a greater reduction in pain and had fewer dropouts than the other 2 groups. In addition to the fact that pain was the only outcome measure assessed, the foot orthoses group had the confounding short-term effect of taping.³¹

II Turlik et al⁵⁷ focused on the effect of foot orthoses alone by evaluating 60 patients with plantar fasciitis, assigned to either a custom, functional foot orthosis group (n = 26), or a generic gel heel pad group (n = 34). While the actual duration of the intervention was unclear, most patients were followed for at least 3 months, with 5 subjects dropping out of the heel pad group. To assess patient outcomes, a 5-item outcome survey was developed by the authors. The authors reported that the custom, functional foot orthoses group had better outcomes than the heel pad group. Unfortunately, the author-developed outcome scale was not evaluated for reliability or validity and the group assignment was not blinded.⁵⁷

I Pfeffer et al⁴² conducted a randomized multicenter trial involving 236 patients diagnosed with plantar fasciitis recruited from 15 orthopaedic foot and ankle clinics. The patients in the study were used to evaluate 5 different treatments: (1) calf stretching only, (2) a silicone heel pad and calf stretching, (3) a felt arch insert and calf stretching, (4) a rubber heel cup and calf stretching, and (5) a custom, functional foot orthosis and calf stretching. The patients were followed for an 8-week period and they used the pain subscale of the Foot Function Index (FFI) as their outcome measure. They reported that the groups treated with the prefabricated inserts (silicone pad, felt arch insert, rubber heel cup) had significantly better outcomes than the group treated with custom orthotics and the group treated with stretching only. Although the 8-week intervention period for this study was extremely short, the results indicate that prefabricated orthoses are effective and that stretching and prefabricated orthoses are more effective than stretching alone.⁴²

II Martin et al³² evaluated custom foot orthoses in comparison to prefabricated arch supports and night splints in 255 patients with plantar fasciitis. Patients were randomly assigned to 1 of 3 treatment groups and the primary outcome measures were self-reported first step pain as well as pain during work, leisure, and exercise activities using a visual analogue scale. Of the 255 patients initially enrolled in the study, only 193 were seen at the final 12-week follow-up visit. Patients in the prefabricated orthoses group and the night splint group had the poorest compliance rates and the highest number of patients withdrawn, with 21% and 26%, respectively. At the 12-week follow-up visit, there was no significant difference in pain reduction between the 3 groups. The authors did indicate that patient compliance was greatest with the use of custom foot orthoses.³²

I To date, the most long-term, comprehensive clinical study of the effectiveness of foot orthoses in the management of plantar fasciitis was conducted by Landorf et al.²⁹ They conducted a participant-blinded, randomized trial utilizing 136 patients with a clinical diagnosis of plantar fasciitis. Patients were randomly allocated to 1 of 3 treatment groups: (1) a sham orthosis constructed of soft, thin foam (n = 46), (2) a prefabricated firm foam orthosis (n = 44); and (3) a custom, semirigid thermoplastic orthosis (n = 46). The outcome measure used was the pain and function domains of the Foot Health Status Questionnaire (FHSQ). Outcomes were assessed prior to initiation of treatment, at 3 months, and at 12 months. At the 3- and 12-month follow-up visits, each group lost only 1 to 2 members to follow-up, so that the total number of patients reviewed at 12 months was 131. After 3 months,

FHSQ pain and function scores favored the use of prefabricated and custom orthoses over the sham orthoses, although only the effects on function were significant. There were no significant differences for pain and function scores among any of the 3 treatment groups at the 12-month review. Thus, while the prefabricated and custom orthoses did produce a short-term effect in pain and function, after 1 year of wear all 3 types of foot orthoses produced a similar patient outcomes.²⁹

A Prefabricated or custom foot orthoses can be used to provide short-term (3 months) reduction in pain and improvement in function. There appears to be no differences in the amount of pain reduction or improved function created by custom foot orthoses in comparison to prefabricated orthoses. There is currently no evidence to support the use of prefabricated or custom foot orthoses for long-term (1 year) pain management or function improvement.

NIGHT SPLINTS

II CRAWFORD AND THOMSON¹² IN THEIR COCHRANE review reported limited evidence to support the use of night splints as an intervention for patients with plantar fasciitis lasting more than 6 months. A key clinical issue is the duration of use once night splint therapy has been initiated. Batt et al⁷ reported that between 9 and 12 weeks of night splint wear time was required to achieve a good outcome in 40 patients with chronic plantar fasciitis. Powell et al⁴⁴ found that only 1 month of wearing the night splint was sufficient to create an 88% improvement in 37 patients with chronic plantar fasciitis. Therefore, based on limited evidence, it would appear that a night splint should be worn between 1 and 3 months to achieve adequate symptom improvement.

II In a recent study, Roos et al⁵⁰ investigated the effects of foot orthoses and night splints, either individually or combined, in a prospective, randomized trial with a 1-year follow-up. Forty-three patients with a mean duration of symptoms of 4.2 months were assigned to 1 of 3 groups: foot orthoses only (n = 13), foot orthoses and night splint (n = 15), or night splint only (n = 15). Follow-up data were available on 38 patients after 1 year. While previous studies had used a posterior night splint, Roos et al⁵⁰ utilized an anterior night splint. In addition to daily logs to monitor compliance, the Foot and Ankle Outcome Score (FAOS) was used as an outcome measure. The results indicated that compliance to either the foot orthoses or night splint was good (at least 75%) and all 3 groups had a reduction in pain as early as 6 weeks and at the 1-year follow-up. Improvements in function as determined using the FAOS supported the use of foot orthoses over night splints.

III Most night splints, whether anterior or posterior in design, are fabricated using a rigid thermoplastic material that can be uncomfortable for the patient and lead to noncompliance. More recently, a soft, sock-type night splint has been made commercially available that utilizes a Velcro strap to position the ankle in neutral and the toes in slight extension. Barry et al⁶ retrospectively analyzed the use of this type of night splint in comparison to standing calf stretching in 160 patients with a clinical diagnosis of plantar fasciitis. The mean duration of symptoms for all 160 patients prior to the start of treatment was approximately 2 months. Although there are numerous issues with this study including poor control of introduction of adjunctive treatments, a 13% dropout of the patients receiving calf stretching, and the use of pain as the only outcome measure, the use of the sock-type night splint did result in a shorter recovery time and fewer additional interventions.⁶ A prospective, randomized controlled trial is required to validate this specific type of night splint.

B Night splints should be considered as an intervention for patients with symptoms greater than 6 months in duration. The desired length of time for wearing the night splint is 1 to 3 months. The type of night splint used (ie, posterior, anterior, sock-type) does not appear to affect the outcome.

CLINICAL GUIDELINES

Summary of Recommendations

F PATHOANATOMICAL FEATURES

Clinicians should assess for impairments in muscles, tendons, and nerves, as well as the plantar fascia, when a patient presents with heel pain.

B RISK FACTORS

Clinicians should consider limited ankle dorsiflexion range of motion and a high body mass index in nonathletic populations as factors predisposing patients to the development of heel pain/plantar fasciitis.

B DIAGNOSIS/CLASSIFICATION

Functional limitations associated with pain in the plantar medial heel region, most noticeable with initial steps after a period of inactivity but also worse following prolonged weight bearing, and often precipitated by a recent increase in weight-bearing activity, are useful in classifying a patient into the ICD category of plantar fasciitis and the associated ICF impairment-based category of heel pain (b28015 Pain in lower limb; b2804 Radiating pain in a segment or region).

The following physical examination measures may be useful in classifying a patient with heel pain into the ICD category of plantar fasciitis and the associated ICF impairment-based category of heel pain (b28015 Pain in lower limb; b2804 Radiating pain in a segment or region):

- Symptom reproduction with palpatory provocation of the proximal plantar fascia insertion
- Active and passive talocrural joint dorsiflexion range of motion
- The tarsal tunnel syndrome test
- The windless test
- The longitudinal arch angle

F DIFFERENTIAL DIAGNOSIS

Clinicians should consider diagnostic classifications other than heel pain/plantar fasciitis when the patient's reported functional limitations or physical impairments are not consistent with those presented in the diagnosis/classification section of this guideline, or, the patient's symptoms are not resolving with interventions aimed at normalization of the patient's physical impairments.

A EXAMINATION: OUTCOME MEASURES

Clinicians should use validated self-report questionnaires, such as the Foot Function Index (FFI), Foot Health Status Questionnaire (FHSQ), or the Foot and Ankle Ability Measure (FAAM), before and after interventions intended to alleviate the physical impairments, functional limitations, and activity restrictions associated with heel pain/plantar fasciitis. Physical therapists should consider measuring change over time using the FAAM as it has been validated in a physical therapy practice setting.

F EXAMINATION: FUNCTIONAL LIMITATION MEASURES

Clinicians should utilize easily reproducible functional limitations and activity restrictions measures associated with the patient's heel pain/plantar fasciitis to assess the changes in the patient's level of function over the episode of care.

B INTERVENTIONS: MODALITIES

Dexamethasone 0.4% or acetic acid 5% delivered via iontophoresis can be used to provide short-term (2 to 4 weeks) pain relief and improved function.

E INTERVENTIONS: MANUAL THERAPY

There is minimal evidence to support the use of manual therapy and nerve mobilization procedures short-term (1 to 3 months) for pain and function improvement. Suggested manual therapy procedures include: talocrural joint posterior glide, subtalar joint lateral glide, anterior and posterior glides of the first tarsometatarsal joint, subtalar joint distraction manipulation, soft tissue mobilization near potential nerve entrapment sites, and passive neural mobilization procedures.

B INTERVENTIONS: STRETCHING

Calf muscle and/or plantar fascia-specific stretching can be used to provide short-term (2 to 4 months) pain relief and improvement in calf muscle flexibility. The dosage for calf stretching can be either 3 times a day or 2 times a day utilizing either a sustained (3 minutes) or intermittent (20 seconds) stretching time, as neither dosage produced a better effect.

C INTERVENTIONS: TAPING

Calcaneal or low-Dye taping can be used to provide short-term (7 to 10 days) pain relief. Studies indicate that taping does cause improvements in function.

A INTERVENTIONS: ORTHOTIC DEVICES

Prefabricated or custom foot orthoses can be used to provide short-term (3 months) reduction in pain and improvement in function. There appear to be no differences in the amount of pain reduction or improvement in function created by custom foot orthoses in comparison to prefabricated orthoses. There is currently no evidence to support the use of prefabricated or custom foot orthoses for long-term (1 year) pain management or function improvement.

B INTERVENTIONS—NIGHT SPLINTS

Night splints should be considered as an intervention for patients with symptoms greater than 6 months in duration. The desired length of time for wearing the night splint is 1 to 3 months. The type of night splint used (ie, posterior, anterior, sock-type) does not appear to affect the outcome.

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