Heel Pain – Plantar Fasciitis: Revision 2023

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Heel Pain – Plantar Fasciitis: Revision 2023

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

J Orthop Sports Phys Ther. 2023:XX(X).A1-A_. doi:##.####/jospt.####.####

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Abstract

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). The purpose of these revised clinical practice guidelines is to review recent peer-reviewed literature and make recommendations related to nonarthritic heel pain.

Summary of Recommendations

INTERVENTIONS – MANUAL THERAPY

A
Clinicians should use manual therapy directed at the joints and soft tissue structures of the lower extremity to address relevant joint and flexibility restrictions, decrease pain, and improve function in individuals with plantar heel pain/plantar fasciitis.

INTERVENTIONS – STRETCHING

A
Clinicians should use plantar fascia-specific and gastrocnemius/soleus stretching to provide short-term and long-term pain reduction as well as to improve short and long-term function and disability.

INTERVENTIONS – TAPING

A
Clinicians should use foot taping techniques, either rigid or elastic, in conjunction with other physical therapy treatments for short-term (one to ≤ six weeks) improvements in pain and function in individuals with plantar fasciitis.

INTERVENTIONS – FOOT ORTHOSES

B
Clinicians should not use orthoses, either prefabricated or custom fabricated/fitted, as an isolated treatment for short-term pain relief in individuals with plantar fasciitis.

C
Clinicians may use orthoses, either prefabricated or custom fabricated/fitted, when combined with other treatments in individuals with heel pain/plantar fasciitis to reduce pain and improve function.

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INTERVENTIONS – NIGHT SPLINTS

A
Clinicians should prescribe a 1- to 3-month program of night splints for individuals with heel pain/plantar fasciitis who consistently have pain with the first step in the morning.

INTERVENTIONS – PHYSICAL AGENTS – ELECTROTHERAPY

D
Clinicians should use manual therapy, stretching, and foot orthoses instead of electrotherapeutic modalities to promote intermediate and long-term (1–6 months) improvements in clinical outcomes for individuals with heel pain/plantar fasciitis. Clinicians may use iontophoresis or pre-modulated interferential current electrical stimulation as a second line of treatment.

INTERVENTIONS – PHYSICAL AGENTS – LOW-LEVEL LASER THERAPY

B
Clinicians should use LLLT as part of a rehabilitation program in those with acute or chronic plantar fasciitis to decrease pain in the short-term.

INTERVENTIONS – PHYSICAL AGENTS – PHONOPHORESIS

C
Clinicians may use phonophoresis with ketoprofen gel to reduce pain in individuals with heel pain/plantar fasciitis.

INTERVENTIONS – PHYSICAL AGENTS – ULTRASOUND

A
Clinicians should not use ultrasound to enhance the benefits of stretching treatment in those with plantar fasciitis.

INTERVENTIONS - PHYSICAL AGENTS – THERMAL

C
Clinicians may recommend the application of local heat applied for four hours to trigger points in the gastrocnemius/soleus, using a specialized device that maintains a safe temperature, for immediate decrease in local pain and improvement in pressure thresholds in those with plantar fasciitis.

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INTERVENTIONS - EDUCATION AND COUNSELING FOR WEIGHT LOSS

E
Clinicians may provide education and counseling on exercise strategies to gain or maintain optimal lean body mass for individuals with heel pain/plantar fasciitis. Clinicians may also refer individuals to an appropriate health care practitioner to address nutrition issues.

INTERVENTIONS - THERAPEUTIC EXERCISE AND NEUROMUSCULAR RE-EDUCATION

C
Clinicians should prescribe therapeutic exercise that includes resistance training for the musculature of the foot and ankle.

INTERVENTIONS – DRY NEEDLING

B
Clinicians should use dry needling to MTrP in the gastrocnemius, soles and plantar muscles for short- and long-term pain reduction as well as long-term improvements in function and disability.

List of Abbreviations

ADL: Activities of Daily Living
ACR: American College of Radiology
AOFAS: American Orthopaedic Foot and Ankle Society
AOPT: Academy of Orthopaedic Physical Therapy
APTA: American Physical Therapy Association
CFO: Custom Foot Orthotic
CI: Confidence Interval
CPG: Clinical Practice Guideline
CSI: Corticosteroid Injections
DN: Dry Needling
ESWT: Extracorporeal Shockwave Therapy
FAAM: Foot and Ankle Ability Measure
FADI: Foot and Ankle Disability Index
Foot and Ankle Outcome Score: FAOS
FFI: Foot Function Index
FHSQ: Foot Health Status Questionnaire
FPFS: Foot Pain and Function Scale
FPI-6: Foot Posture Index-6
GROC: Global Rating of Change
HEP: Home Exercise Program
IASTM: Instrument-Assisted Soft Tissue Mobilization
ICD: International Classification of Diseases
ICF: International Classification of Functioning, Disability and Health
JOSPT: Journal of Orthopaedic & Sports Physical Therapy
LEFS: Lower Extremity Functional Scale
LLLT: Low Level Laser Therapy

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MCID: Minimal Clinically Important Difference
MD: Mean Difference
MFR: Myofascial Release
MPC: Monophasic Pulsed Current
MRI: Magnetic resonance imaging
MTrP: Myofascial Trigger Point
NPRS: Numerical Pain Rating Scale
NSAID: Nonsteroidal Anti-inflammatory Drug
PPT: Pain Pressure Threshold
PRP: Platelet-Rich Plasma
PSFS: Patient-Specific Functional Scale
RCT: Randomized Clinical Trial
ROM: Range of Motion
SEBT: Star Excursion Balance Test
SF-36: 36-Item Short-Form Health Survey
SMD: Standard Mean Difference
SWT: Shock Wave Therapy
US: Ultrasound
VAS: Visual Analog Scale

Introduction

The 2023 Heel Pain-Plantar Fasciitis Clinical Practice Guideline (CPG) is a revision of the 2014 CPG and represents the third CPG from the Academy of Orthopaedic Physical Therapy (AOPT) on this topic. Plantar heel pain is an umbrella term that may represent a number of different diagnoses. These diagnoses include not only plantar fasciitis, but other pathoanatomical causes of heel pain, such as heel fat pad syndrome, heel spur syndrome, nerve irritation, and calcaneal stress fracture. This CPG update will focus on the clinical entity of plantar fasciitis, the most recognized cause of plantar heel pain. Plantar fasciitis is characterized by medial plantar heel pain with tenderness at the medial calcaneal tubercle and symptoms that are most noticeable with weight bearing first thing in the morning or after a period of rest.

The body of research concerning the treatment for individuals with plantar fasciitis is steadily expanding. In preparation for this update, a review done on the topic of plantar fasciitis identified 64 meta-analyses and 126 systematic reviews that have been published after the search date of 12/31/2012 for the prior 2014 CPG revision. The topics addressed in this 2023 CPG revision will specifically attempt to answer the question: what is the evidence to support physical therapy interventions directed at patients with plantar fasciitis?

Prevalence, pathoanatomical features, and clinical course were reviewed in detail in both the original 2008 CPG and 2014 CPG revision and, therefore, will only be briefly reviewed in this 2023 update. Plantar fasciitis contributes to approximately 15% of foot pathology in the general population and occurs most commonly in those between 40 and 60 years of age, without a sex bias.[67], [33], [50]. While the condition may affect both athletic and non-athletic populations, the incidence is reportedly higher among runners.[67] Occupations that require a considerable amount of standing time may also be more affected. [67], [33], [50] Plantar fasciitis presents as a gradual onset of pain usually related to a change in weight-bearing activity. Typically, pain occurs with weight bearing after a period of rest. This pain may

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initially decrease with activity, but return again after prolonged periods of weight bearing. The origin of the plantar fascia at the medial calcaneal tubercle may be subject to high levels of stress as it assists in supporting the medial longitudinal arch during the push-off phase of the gait cycle. [33] Those with plantar fasciitis usually have a symptom duration greater than one year prior to seeking treatment. [50] Although the name plantar fasciitis infers that the pathology is a primary inflammatory condition, it is widely understood that the pathology may exist along a spectrum that includes both inflammatory and degenerative characteristics.

Aim of the Guidelines

The Orthopaedic Section of the American Physical Therapy Association (APTA) has an ongoing effort to create evidence-based CPGs 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). [2]

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

These guidelines are not intended to be construed or to serve as a standard of medical care for physical therapists. 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; the diagnostic and treatment options available; and the patient's values, expectations, and preferences. However, we suggest that significant departures from accepted

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guidelines should be documented in the patient's medical records at the time the relevant clinical decision is made.

Organization of the Guideline

Prevalence, pathoanatomical features, and clinical course of plantar fasciitis are briefly reviewed in the introduction. The 2014 CPG recommendations are restated for risk factors, diagnosis, and differential diagnoses, as well as examination related to outcome measures, activity/participation restriction measures, and physical impairment measures. The authors of this 2023 CPG update have provided an outline for a foot and ankle-specific examination based on expert opinion. Related to physical therapy interventions for those with plantar fasciitis, a systematic review was conducted to identify randomized clinical trials (RCT) or systematic reviews and meta-analyses of RCTs that support specific actionable recommendations. When appropriate, the prior 2014 recommendation was provided, followed by a summary of updated literature with the corresponding evidence levels, synthesis of evidence, and rationale for the recommendation(s) with harms and benefits statements, gaps in knowledge, and updated recommendation(s).

Scope and Rationale of the Guideline

The primary intent of this third CPG on the topic of plantar fasciitis was to focus on updating recommendations for interventions to be used in physical therapist practice. The recommendations for risk factors, diagnosis, differential diagnosis, and examination did not fundamentally change between the original 2008 and the 2014 revision CPG. This was true for prevalence, pathoanatomical features, and clinical course. A search and review done in preparation for this update did not find additional literature after the last search completed for the 2014 revision (December 31, 2012) on prevalence, pathoanatomical features, clinical course, risk factors, diagnosis, differential diagnosis, and examination that would necessitate fundamental changes to the prior CPG to improve the management of patients with plantar fasciitis. An update on the imaging summary from the 2014 revision, primarily based on the American College of Radiology (ACR) recommendation is provided in this 2023 CPG. Therefore, a systematic review was only conducted for the evidence on interventions within the scope of physical therapist practice for those with the diagnosis of plantar fasciitis. This CPG excluded interventions outside the scope of physical therapist practice, including but not limited to pharmacological and surgical interventions, unless directly compared to physical therapy management. Although used by some physical therapists outside the United States, extracorporeal shockwave therapy (ESWT) was also considered outside the scope of physical therapist practice for this update. A scoping review and summary was presented for ESWT, as well as corticosteroid (CSI) and platelet-rich plasma (PRP) injections, because they are frequently prescribed as conservative interventions and may be of interest for consideration in patients who are not benefiting from physical therapy.

Methods

Content experts were appointed by the AOPT to conduct a review of the literature and develop an updated CPG for plantar fasciitis. This second revision aims to provide a concise summary of contemporary evidence since the publication of the 2014 revision and to develop new recommendations or revise previously published recommendations to support evidence-based practice. The authors of this guideline revision worked with the CPG editors and medical librarians for methodological guidance. Two authors (C.M.M. and R.L.M.) served as the team's methodologists. The

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research librarians were chosen for their expertise in systematic review and rehabilitation literature searching, and to perform systematic searches regarding intervention strategies for plantar fasciitis. Briefly, the following databases were searched from December 2012 to June 2022: MEDLINE, CINAHL, Cochrane Library, and PEDro (see **APPENDIX A** for full search strategies and **APPENDIX B** for search dates and results, available at **www.orthopt.org**).

The authors declared relationships and developed a conflict management plan, which included submitting a conflict-of-interest form to the AOPT. Articles that were authored by a reviewer were assigned to an alternate reviewer. Funding was provided to the CPG development team for travel and expenses for CPG development training by the AOPT. The CPG development team maintained editorial independence from funding agencies, including the AOPT Board of Directors.

Articles contributing to recommendations were reviewed based on specified inclusion and exclusion criteria, with the goal of identifying evidence relevant to physical therapist clinical decision making for patients with plantar fasciitis. The title and abstract of each article were reviewed independently by two members of the CPG development team for inclusion (see **APPENDIX C** for inclusion and exclusion criteria, available at **www.orthopt.org**). A full-text review was then similarly conducted to obtain the final set of articles for contribution to recommendations. The team leader (C.M.M.) provided the final decision on discrepancies that were not resolved by the review team (see **APPENDIX D** for the flow chart of articles, available at **www.orthopt.org**). Data extraction and assignment of level of evidence were also performed by two members of the CPG development team. Evidence tables for this CPG are available on the Clinical Practice Guidelines page of the AOPT website (**www.orthopt.org**).

This guideline was issued in 2023 based on the published literature through DATE and will be considered for review in 2028, or sooner if new evidence becomes available. Any updates to the guideline in the interim period will be noted on the AOPT website (**www.orthopt.org http://www.orthopt.org**).

Levels of Evidence

Individual clinical research articles were graded according to criteria adapted from the Centre for Evidence-Based Medicine, Oxford, UK (**http://www.cebm.net**) for the studies related to interventions. [1] In teams of two, each reviewer assigned a level of evidence and evaluated the quality of each article using a critical appraisal tool (see **APPENDICES D** and **E** for the levels-of-evidence table and details on procedures used for assigning levels of evidence, available at **www.jospt.org**). If the 2 content experts did not agree on a grade of evidence for a particular article, a third content expert was used to resolve the issue. The evidence update was organized from the highest level of evidence to the lowest level of evidence. An abbreviated version of the grading system is provided in **TABLE 1**.

I	Evidence obtained from systematic reviews, high-quality diagnostic studies, prospective studies, or randomized controlled trials
II	Evidence obtained from systematic reviews, lesser-quality diagnostic studies, prospective studies, or randomized controlled trials (e.g. weaker diagnostic criteria and reference standards, improper randomization, no blinding, less than 80% follow-up)
III	Case-control studies or retrospective studies
IV	Case series

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V	Expert opinion

Strength of Evidence and Grades of Recommendation

The strength of the evidence supporting the recommendations was graded according to the established methods provided below (**TABLE 2**). Each team developed recommendations based on the strength of evidence, including how directly the studies addressed the question relating to plantar fasciitis. In developing their recommendations, the authors considered the strengths and limitations of the body of evidence and the health benefits, side effects, and risks associated with the interventions.

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 science/bench research supports the recommendation
F	Expert opinion	Best practice based on the clinical experience of the guidelines development team

Guideline Review Process and Validation

The AOPT selected consultants from the following areas to serve as reviewers throughout the development of these CPGs:

- Athletic training
- Claims review
- Coding
- Guideline methodology
- Foot and ankle rehabilitation
- Medical practice guidelines
- Manual therapy

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- Movement science
- Orthopaedic physical therapy clinical practice
- Orthopaedic physical therapy residency education
- Orthopaedic surgery
- Outcomes research
- Patients with plantar fasciitis
- Physical therapy academic education
- Physical therapy patient perspective
- Rheumatology
- Sports physical therapy residency education
- Sports rehabilitation

Identified reviewers who are experts in the management and rehabilitation of those with plantar fasciitis reviewed a pre-publication draft of this CPG content and methods for integrity, accuracy, validity, usefulness, and impact. Any comments, suggestions, or feedback from the expert reviewers were delivered to the author and editors for consideration and appropriate revisions. These guidelines were also posted for public comment on the AOPT website (**www.orthopt.org**), and a notification of this posting was sent to the members of the AOPT. Any comments, suggestions, and feedback gathered from public commentary were sent to the authors and editors to consider and make appropriate revisions to the guideline, prior to submitting them for publication to the *Journal of Orthopaedic & Sports Physical Therapy (JOSPT)* .

Dissemination and Implementation Tools

In addition to publishing these guidelines in the *JOSPT*, these guidelines will be posted on the CPG (free access) areas of the *JOSPT* and AOPT websites and submitted for free access on the ECRI Guidelines Trust (**guidelines.ecri.org**) and the Physiotherapy Evidence Database (**www.PEDro.org.au**). The planned implementation tools for patients, clinicians, educators, payers, policy makers, and researchers, and the associated implementation strategies are listed in **TABLE 3**.

Tool	Strategy
Mobile applications of guideline-based exercises for patients/clients, athletes, coaches, and health care practitioners	Marketing and distribution of app using www.orthopt.org
Clinician's quick-reference guide	Summary of guideline recommendations available on www.orthopt.org
Read-for-credit continuing education content	Continuing education content available from JOSPT
Webinar-based educational offerings for health care practitioners	Guideline-based instruction available for practitioners on www.orthopt.org
Videos of Knee Injury Prevention Warm-up Exercise Sequences for Field and Court Sport Athletes	Free access links to videos of Exercise Sequences available via this CPG and on www.orthopt.org and www.jospt.org

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Mobile and web-based applications for health care practitioner training	Marketing and distribution of app using www.orthopt.org
Non-English versions of the guidelines and guideline implementation tools	Development and distribution of translated guidelines and tools to JOSPT's international partners and global audience via www.jospt.org
Interactive digital, learning modules and skill-building seminars for practitioners to improve their knowledge of and skills for implementation of the CPGs for prevention and management of common musculoskeletal conditions	Digital resources available through www.orthopt.org and AOPT's Vendor Partners and standardized skill-building seminar available from AOPT's CPG Seminar Co-sponsors, worldwide
Digital resources available through www.orthopt.org and AOPT's Vendor Partners and standardized skill-building seminar available from AOPT's CPG Seminar Co-sponsors, worldwide	Practitioners who attain passing examination scores have the opportunity to gain listing in the Directory of CPG Knowledge Competency, which will be widely accessible to clients, practitioners, employers, and payors.

Clinical Guidelines: Impairment/Function-Based Diagnosis

Classification

The primary International Classification of Diseases 10th revision (ICD-10) code and condition associated with heel pain is M72.2 Plantar fascial fibromatosis/Plantar fasciitis. The primary ICF body function codes associated with plantar fasciitis 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. The primary ICF activities and participation codes associated with plantar fasciitis are d4500 Walking short distances, d4501 Walking long distances, d4154 Maintaining a standing position, d4552 Running, d4553 Jumping, and d9201 Sports. A comprehensive list of codes were published in the previous 2014 CPG.[50]

Risk Factors

2014 Recommendation

B

Clinicians should assess the presence of limited ankle dorsiflexion range of motion, high body mass index in nonathletic individuals, running, and work-related weight-bearing activities—particularly under conditions with poor shock absorption—as risk factors for the development of heel pain/plantar fasciitis.

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Diagnosis

2014 Recommendation

B
Physical therapists should diagnose 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) using the following history and physical examination findings:
• Plantar medial heel pain: most noticeable with initial steps after a period of inactivity but also worse following prolonged weight bearing
• Heel pain precipitated by a recent increase in weight-bearing activity
• Pain with palpation of the proximal insertion of the plantar fascia
• Positive windlass test
• Negative tarsal tunnel tests
• Limited active and passive talocrural joint dorsiflexion range of motion (ROM)
• Abnormal Foot Posture-6 (FPI-6) score
• High body mass index in nonathletic individuals

Differential Diagnosis

2014 Recommendation

C
Clinicians should assess for diagnostic classifications other than heel pain/plantar fasciitis, including spondylarthritis, fat-pad atrophy, and proximal plantar fibroma, when the individual'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 individual's symptoms are not resolving with interventions aimed at normalization of the individual's impairments of body function.

Clinical Guidelines: Examination

Outcome Measures

2014 Recommendation

A
Clinicians should use the Foot and Ankle Ability Measure (FAAM), Foot Health Status Questionnaire (FHSQ), or the Foot Function Index (FFI) and may use the computer-adaptive version of the Lower Extremity Function Scale (LEFS) as validated self-report questionnaires before and after interventions intended to alleviate the physical impairments, activity limitations, and participation restrictions associated with heel pain/plantar fasciitis.

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Activity Limitation Measures

2014 Recommendation

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

Physical Impairment Measures

2014 Recommendation

B
When evaluating a patient with heel pain/plantar fasciitis over an episode of care, assessment of impairment of body function should include measures of pain with initial steps after a period of inactivity and pain with palpation of the proximal insertion of the plantar fascia, and may include measures of active and passive ankle dorsiflexion range of motion and body mass index in nonathletic individuals.

Foot and Ankle Examination Outline

To assist with the collection of impairment-based measures, the authors of this CPG formulated an outline for a foot and ankle specific examination based on expert opinion. It should be noted that a comprehensive lower quarter screen can be performed if needed based on the individual's presentation.

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Supine Range of Motion*	Dorsiflexion knee extended Dorsiflexion knee flexed Plantar flexion Supination/Inversion Pronation/Eversion Great toe extension *Joint mobility assessment when deficits are identified
Manual Muscle Testing	Anterior tibialis Posterior tibialis Fibularis longus and brevis
Standing	Heel raise (gastroc-soleus muscle strength) Dorsiflexion lunge test/ Tibio-pedal dorsiflexion range of motion Foot Posture Index 6 Single leg squat Gait Leg length
Special tests	Windlass Tinel's with dorsiflexion eversion
Palpation	Medial calcaneal tubercle Trigger point assessment of the Gastroc-soleus muscle Body of the calcaneus to rule out stress fracture Plantar surface of the calcaneus to rule out fat pad atrophy Posterior aspect of the calcaneus to rule out insertional Achilles tendinopathy Mid-substance of the plantar fascia to rule out plantar fibromatosis

Comprehensive lower quarter screen can be performed if needed based on the individual's presentation.

Imaging

Imaging studies are usually not indicated for patients that meet clinical examination criteria for plantar fasciitis until they fail conservative interventions. When clinicians are considering imaging studies, the ACR Appropriateness Criteria for "Chronic Foot Pain" aligns with the imaging recommendations for those with plantar fasciitis. **(https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria)** These recommendations note that conventional weight bearing radiography is the first imaging study of choice for those with chronic foot pain. If radiographs are negative and clinical examination potentially indicates plantar fasciitis, plantar fascia tear, tarsal tunnel syndrome, and/or Baxter's neuropathy, a magnetic resonance imaging (MRI) without contrast or diagnostic ultrasound (US) is usually appropriate as the next imaging study. When specifically looking for increased plantar fascia thickness, no significant differences have been found between diagnostic US and MRI.[70]The ACR Appropriateness Criteria noted that some of the findings associated with plantar fasciitis are nonspecific and may also be seen in asymptomatic patients.[70] If therapists are using point-of-care US, findings suggested to be diagnostic of plantar fasciitis include fascial thickening (exceeding 4mm) and hypoechoic appearance. [11], [52] For those potentially with Baxter's neuropathy, diagnostic US may be combined with diagnostic and therapeutic injections around the inferior calcaneal nerve. In addition to imaging studies, electrophysiologic studies

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may be helpful in the diagnosis of tarsal tunnel syndrome, entrapment of the medial calcaneal nerve, and S1 radiculopathy.**(https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria)**

Clinical Guidelines: Interventions

Manual Therapy

Operational Definitions

The terms used in the manual therapy section may require operational definitions of the terms to avoid confusion. Joint mobilization can include thrust and nonthrust techniques and cover a continuum of skilled passive movement applied at varying speeds and amplitudes within or at the end range of motion (ROM) of a joint. Techniques that address soft tissue restrictions and/or pain can include soft tissue mobilization, massage, and dry cupping techniques. Soft tissue mobilization is defined as skilled passive movement of soft tissue, including fascia, muscles, and ligaments, to reduce pain and/or improve ROM. Specific soft tissue mobilization techniques may include Instrument-Assisted Soft-Tissue Mobilization (IASTM), myofascial release (MFR), myofascial trigger point therapy (MTrP), muscle energy, and strain/counterstrain techniques. Massage is a general term referring to techniques using the hands to promote relaxation of underlying muscles. Dry cupping is an intervention that uses heated ceramic or glass cups put directly on the skin. As the cups cools, a suction effect is created to mobilize tissue while increasing blood flow and tissue relaxation. [27]

2014 Recommendation

A

Clinicians should use manual therapy, consisting of joint and soft tissue mobilization procedures to treat relevant lower extremity joint mobility and calf flexibility deficits and to decrease pain and improve function in individuals with heel pain/plantar fasciitis.

Dry Cupping

I

Two RCTs by al Khadhrawi & Alshami [6] and Malik et al, [49] investigated the immediate effect of dry cupping and stretching (n = 36; mean age, 41 ± 10 years; 21 males, 15 females) compared to active ROM and stretching (n = 35; mean age, 44 ± 10 years; 19 males, 16 females). Outcomes included the pain visual analogue scale (VAS), pressure pain threshold (PPT), the Patient-Specific Functional Scale (PSFS), the Star Excursion Balance Test (SEBT), and the figure-of-eight hop test. Secondary outcomes included dorsiflexion ROM. Khadhrawi et al, [6] showed a greater decrease of approximately two points on the pain VAS at the time of treatment. Pain pressure threshold also improved significantly in the intervention group immediately after intervention with a large effect size observed (partial eta squared 0.174). These differences were not maintained after two days for either pain measure. There were no differences between groups in other outcomes. Immediate ankle dorsiflexion ROM was measured with the knee extended and the knee flexed in a modified lunge position. The intervention group showed increased significantly compared to the control with a large effect size observed (partial eta squared 0.223) but was not observed two days later. Malik et al, [49] showed greater improvement in 100-point pain VAS of -

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34.03 points in the dry cupping group after four weeks of treatment. These studies indicate that dry cupping combined with conventional interventions reduces short-term pain and briefly increases ROM.

Myofascial Trigger Point Therapy

I

A RCT by Lilly et al, [46] investigated the effects of MTrP therapy, US, and stretching (n = 21; mean age, 42.85 ± 11.2 years; 7 males, 14 females) compared to US and stretching (n = 21; mean age 42.66 ± 12.25 years; 7 males, 14 females). The parameters used for the MTrP therapy group included pressure over trigger points of the gastrocnemius, soleus, and peroneal muscles until release of the taut band within the muscle was felt by the therapist. Outcomes included PPT, the numerical pain rating scale (NPRS), and the FAAM. Measurements were taken at baseline and the conclusion of treatment (two weeks). Large effect sizes were observed and found to be statistically significant for pain on the VAS (2.9), the FAAM (1.5), and PPT (0.7). Results favored the use of trigger point release in conjunction with US and stretching for short term (two weeks) effects.

Joint Mobilization

II

A RCT by Grim et al, [29] compared impairment-based foot, ankle and spine joint mobilization ("manual therapy") (n = 21; 5 males,16 female;), customized foot orthoses (n = 21; mean age, 48.8 ± 9.8 years; 7 males, 14 females) and manual therapy combined with customized foot orthoses (n = 21; mean age, 48.8 ± 9.8 years; 7 males, 14 females). The impairment-based intervention included identification of impairments of the foot, ankle, and spine, and treating the identified impairments with joint mobilizations to increase overall joint mobility. Pain and function were evaluated using American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot Scale and the Foot Pain and Function Scale (FPFS). The manual therapy group showed greater improvements when compared to the customized foot orthoses and combined therapy group ($P < .01$) over the three-month intervention period. Manual therapy, when compared to customized foot orthoses and combined interventions, offers greater clinical benefits for decreasing pain and improving function. The magnitude of effect was not reported.

II

A RCT by Kashif et al, [39] compared subtalar mobilization (n = 25; mean age 32.40 ± 8.02 years; 11 males, 14 females) to "conventional physiotherapy" (n= 27; mean age 32.59 ± 7.00 years; 16 males, 11 females). The subtalar mobilization group received joint mobilization with movement for 15 minutes, stretching to the gastroc soleus complex for 15 minutes, and rigid taping. The conventional therapy group received US for 15 minutes, stretching for 15 minutes, and rigid taping. Each patient received two sessions per week for a total of three weeks. Pain and function were evaluated at baseline and three weeks using the VAS and the Foot and Ankle Disability Index (FADI). Patients who received subtalar mobilization with movement, stretching exercise plus rigid taping showed greater improvement in pain and functional when compared to those who received US, stretching exercise and rigid t**aping.** The results for the VAS after three weeks of treatment indicated a mean difference of 0.41, SE: 0.20, P =.023. The results for the FADI after three weeks of treatment indicated a mean difference of 2.04, SE: 1.01, P =.024.

II

Kumar et al,[43] conducted a RCT investigating the effect of "conventional therapy": US, electrical stimulation and home stretching (n = 10) versus conventional therapy plus subtalar mobilization (n =

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11). Outcomes included pain (VAS) and disability (FADI). Participants were assessed at baseline, day three, and day five. The VAS results in the conventional therapy group had a mean difference of 3.5 (SD ± 1.26) from day 1 to 5, the subtalar mobilization group had a mean difference of 7.56 (SD ± 0.93) from day 1 to 5. The results for both groups showed improvement however the subtalar mobilization group showed almost full recovery on the VAS, the statistical analysis suggested the p-value for inter and intra group comparisons are significant for day 5, and for mean difference between day 1 - 5 (*P* =.005). The FADI results for the conventional group improved on average 28.2 points (SD ± -15.3) where the joint mobilization group improved 48.1 (SD ± 7.91) points (*P* =.003) between day 1 - 5. This suggests subtalar mobilization combined with conventional therapy was more effective than conventional therapy alone in reducing short-term pain.

Soft Tissue Mobilization

II

Pollack et al, [60] and Fraser et al, [25] conducted systematic reviews of the literature examining the effect of manual therapy on pain and function. The studies included in these reviews had limitations that resulted in lowering the level of evidence. Fraser et al, [25] included seven trials, all of which were included in Pollack et al, [60]. Trials included both soft tissue mobilization and joint mobilization as the comparator. Within these two reviews, there were three studies that specifically assessed the effect of soft-tissue mobilization techniques [69], [3], [15] Saban et al, [69], and assessed deep massage to the posterior calf with neural mobilization compared to ultrasound and self-stretch. Their results favored the manual therapy group with mean change of 15 points (95% CI: 9, 21) compared to 6 points (95% CI: 1, 11) on the Foot & Ankle Computerized AdaptedTest over the six week intervention period. Ajimsha et al, [3], [15], found large between group effect sizes ranging from 1.45 – 1.63 (95% CI: 0.4, 1.7) for PPT when using myofascial release directed specifically at the gastrocnemius, soleus, and the plantar myofascia. Assessments were taken at baseline, week four and week 12. Cleland, [15] and Shashua [75], used aggressive soft tissue mobilization directed at the triceps surae and insertion of the plantar fascia at the medial calcaneal tubercle and found between group differences for soft tissue mobilization and simple stretching.Results favored manual therapy and ranging from 5.89 (95% CI: -3.69, 15.47) to 13.5 (95% CI: 6.3, 20.8) at baseline, four weeks and six months.

II

Four RCTs by Tamil Nidhi et al,[81], Shah & Varadharajulu, [74], Shenoy et al, [76], and Shah, [73] assessed the effects of MFR added to “conventional therapy” compared to conventional therapy. All the studies included the VAS and the FFI, among other measures. There were variations in the definition of “conventional therapy”, but most interventions consisted of stretching, strengthening and modality use. Modalities included Kinesio-Tape, US, and thermal modalities. Sample sizes and results varied across all studies but all results favored the addition of MFR to conventional therapy and modalities. The magnitude of effect was not reported.

Instrument-Assisted Soft Tissue Mobilization

II

One RCT conducted by Bhurchandi & Phansopkar {Burchandi, 2021} compared the effects of IASTM (n = 30; mean age 33.17 ± 8.43 years; 43% males, 57% females) to therapeutic US (n = 34; mean age 36.60 ± 11.59 years; 57% males, 43% female). Both groups were provided a twice per day home exercise program (HEP) which consisted of calf and plantar fascia stretching for 30 seconds each for three

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repetitions. The IASTM group included aggressive instrument assisted STM to the triceps surae and plantar fascia. Outcomes included FAAM scale and the NPRS. Data were collected at baseline (pre-test), after 8 sessions of treatment (post-test), and at 90 days after treatment. At the 90 day follow-up mean values for FAAM scores increased 52 (SD) points in the IASTM group to 99.00 (SD) and 4 (SD) points in the US group to 89.88 (SD), respectively. Secondary outcomes increased as well, favoring the use of IASTM. The results indicated that IASTM and a HEP were superior to US in decreasing the pain intensity and improving function in patients with heel pain.

II

Three RCTs [41],[55],[36] assessed the effect of IASTM using the Graston technique. Two studies [41], [55] had 66 patients randomized into two groups. Follow-up assessments were taken at baseline and two weeks[55] and four weeks[41].Outcome measures included the NPRS, FADI and the lunge test. Pre and pos-test comparisons of 2.58 on the NPRS, 5.0 on the FADI, and 4.76 on the Lunge test, were statistically significant and favored the use of IASTM. Jadhav et al, [36] compared the effectiveness of IASTM using the Gua Sha technique, Cryostretch, or positional release on patients with plantar heel pain. Thirty-six patients were randomized into three groups of twelve. NPRS, FFI and PA. assessments took place at baseline and seven days. Mean differences (MD) pre- and posttest were statistically significant and favored the use of IASTM, but did not reach the minimal clinically important difference (MCID) for any outcome.

Muscle Energy

III

A RCT by Tanwar et al,[82]} investigated the effects of muscle energy and conventional therapy compared to conventional therapy alone. This study was downgraded as it did not report effect sizes or *p* values for any outcomes. The muscle energy technique was performed with the participant in a supine position with the knee flexed for the soleus and the knee was extended position for the gastrocnemius. The parameters for the conventional therapy included: (1) US at a frequency of 1 MHz with the output of 1.5 W/cm^2 for 7 minutes, (2) plantar fascia stretching (3) intrinsic muscle exercises and (4) towel gripping (curls). Outcome measures for this study included ROM of passive dorsiflexion, pain intensity measured using the NPRS, and foot function using the FFI. The results for this study favored manual therapy with superior gains in all measures when muscle energy technique was combined with conventional therapy.

Evidence Synthesis

Overall, recent studies add to the body of evidence supporting the use of manual therapy directed at the joints and soft tissue structures of the lower extremity to improve pain, function and disability. There was one additional level I study and three level II studies, supporting joint mobilization, identified since the previous update. Four additional level II studies supported techniques directed at soft tissue. No new side effects or adverse events were uncovered. Therefore, based on the low risk and the consistent likely benefits of improved pain and function, the preponderance of evidence continues to support manual therapy.

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2023 Recommendation

A Clinicians should use manual therapy directed at the joints and soft tissue structures of the lower extremity to address relevant joint and flexibility restrictions, decrease pain, and improve function in individuals with plantar heel pain/plantar fasciitis.

Stretching

Operational Definitions

Gastrocnemius/soleus stretching involves stretching of the posterior calf structures, including gastrocnemius, soleus, Achilles tendon and related structures. It may be performed by the patient in weight-bearing or non-weight-bearing positions. Gastrocnemius/soleus stretching may include stretching the ankle into dorsiflexion with knee in extension to target the gastrocnemius muscle and structures or in knee flexion to target the soleus muscles, as well as the other short plantarflexors. Gastrocnemius/soleus stretching may be conducted in long-sitting or straight leg raise positioning provide additional stretching to posterior knee and hip structures. We refer to this as hamstring stretching.

Plantar fascia stretching is intended to localize the stretch to the plantar fascia. It is performed in weight-bearing or non-weight-bearing positions, by applying pressure to the metatarsal heads to stretch the forefoot while the toes are stretched into dorsiflexion. Pressure may be applied to the plantar fascia during the stretch.

2014 Recommendation

A
Clinicians should use plantar fascia-specific and gastrocnemius/soleus stretching to provide short-term (1 week to 4 months) pain relief for individuals with heel pain/plantar fasciitis. Heel pads may be used to increase the benefits of stretching.

Evidence Update

I
One high quality systematic review and meta-analysis [77] of 8 RCTs (n = 681) evaluated the impact of plantar fascia stretching and gastrocnemius/soleus stretching on pain VAS (0-100) in patients with plantar fasciitis. There was moderate quality evidence that plantar fascia stretching was superior to gastrocnemius/soleus stretching (MD pain VAS, 12.37 (95% confidence interval (CI): 7.63, 17.10) and plantar fascia stretching combined with EWT was superior to ESWT alone (MD pain VAS, -13.46 (95% CI:-16.00, -10.92) in the short-term (less than three months). There was very low-quality evidence that: (1) combined gastrocnemius/soleus and plantar fascia stretching was superior to other therapies in the short-term (MD pain VAS, 3.66 (95% CI: 6.77, 14.09), (2) combined gastrocnemius/soleus and plantar fascia stretching was superior to sham (MD pain VAS, -14.00 (95% CI: -21.07, -6.93), (3) combined gastrocnemius/soleus and plantar fascia stretching was superior to no stretching (MD pain VAS, -16.00 (95% CI: -23.57, -8.43), (4) gastrocnemius/soleus stretching was superior to sham (MD pain VAS, -11.40 (95% CI: -23.37, 0.57), and (5) plantar fascia specific stretching was superior to extracorporeal shockwave therapy (ESWT) in the short-term (MD pain VAS, -13.52 (95% CI: -23.82, -3.23). The overall

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treatment effect of stretching was large and was comparable to other interventions. There was variation in the duration of gastrocnemius/soleus stretching which ranged from 10 seconds to 60 minutes, 10 to 30 seconds for plantar fascia specific stretching, the duration of treatment ranged from four days to eight weeks, and there is limited evidence on outcomes longer than three months.

Plantar Fascia Compared to Gastrocnemius/Soleus Stretching

I

A RCT by Gupta et al,[32]compared the effectiveness on pain (FFI) and disability (FADI) of four different treatments: (1) Indomethacin or Diclofenac (Group 1:"conventional treatment", n = 35; mean age, 44.4 ± 9.4 years), (2) heat treatment with silicone heel pad (Group 2, n = 35; mean age, 41.5 ± 10.9 years), (3) active plantar fascia stretching with sham gastrocnemius/soleus stretching (Group 3, n = 35; mean age, 46.4 ± 11.9 years), and (4) active gastrocnemius/soleus stretching with sham plantar fascia stretch (Group 4, n = 35; mean age, 41.5 ± 10.3 years). These results indicated plantar fascia stretching with sham gastrocnemius/soleus stretching was more effective than the other three treatments (*P* < .05) over twleve months.

Combined Plantar Fascia, Gastrocnemius/Soleus, Hamstring and Peroneus Stretching

I

A RCT by Kamonseki et al, [37] investigated the effect of stretching with and without muscle strengthening exercises for the foot and hip on balance as measured by the Star Excursion Balance Test (SEBT). Patients were randomly allocated into three groups, a stretching alone exercise group (n = 28; mean age 44.5 ± 11.5 years; 21.5% male,78.5% female), a foot exercise group (n = 27; mean age, 47.7 ± 9.9 years: 23% male, 77% female), and a foot and hip exercise group (n = 28; mean age 47.7 ± 9.9 years; 77% male, 23% female). The stretching intervention included gastrocnemius, soleus, plantar fascia, and gastrocnemius/soleus combined with hamstring stretching. There were no statistically significant differences between the three groups in balance (*P* > .05) after eight weeks.

I

In a RCT by Pinrattana et al, [59] compared the immediate and short-term effects of Kinesiotaping (n = 10; mean age 23.33 ± 1.83 years), self-stretching (n = 10; mean age 22.00 ± 1.25 years), and a combination of Kinesio taping and self stretching (n = 10; mean age 24.63 ± 5.42 years) on pain (VAS 0-10) and function (Manchester Foot Pain and Disability Index). The stretching intervention included gastrocnemius/soleus, plantar fascia, fibularis, and gastrocnemius/soleus combined with hamstring. There was no statistically significant difference between the groups for VAS scores or Manchester Foot Pain and Disability Index (*P* > .05) immediately following the treatment session or after one week.

Combined Plantar Fascia and Gastrocnemius/Soleus Stretching

I

A RCT by Ranbhor et al, [62] compared the effects of foam rolling (n = 25; mean age 33:08 ± 10:83 years) to self-stretching (n = 25; mean age 38:28 ± 13:67 years). The stretching intervention included gastrocnemius/soleus and plantar fascia stretching. Immediately following the interventions, there was no difference between groups in mean VAS (0-10), plantar fascia, gastrocnemius, and soleus PPT (lbs), or

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dorsiflexion ROM (*P* = .171, .372 and .861, respectively), whereas the stretching group had a significantly greater decrease in gastrocnemius PPT (*P* = .029) and soleus PPT (*P* = .013) compared to the foam roller group. At the end of treatment, the self-stretching group had better outcomes for gastrocnemius PPT (PPT % change: stretching group: 32.28; foam roller group: 445.46, *P* = .029) and soleus PPT (PPT % change: stretching group: 30.45; foam roller group: 44.54, *P* = .013). There were statistically significant differences for PPT (*P* = .372) between groups for the plantar fascia.

Combined Plantar Fascia Stretching and Monophasic pulsed current

I

Two articles reporting on one RCT conducted by Alotaibi et al, [7],[8] compared the effects of monophasic pulsed current (MPC) (n = 22; mean age 49.7 ± 11.7 years; 8 males, 14 females) to MPC combined with plantar fascia stretching (n = 22; mean age 49.0 ±9.7 years; 7 males, 15 females) on heel pain VAS (0-10), heel tenderness (pressure algometer), activities of daily living (FAAM-ADL), and plantar fascia thickness (mm). There were no significant differences between the two groups in all outcome measures (*P* = .57). after four weeks. There was no correlation between heel pain and plantar fascia thickness (*r* = −.006, *P* = 0.97) after four weeks.

Plantar Fascia Stretching

II

In a RCT by Engkananuwat et al, [23] compared the effects of "Achilles tendon" stretching (n = 25; mean age 49.8 ± 6.5 years; 10 males, 15 females) to "Achilles tendon" and plantar fascia stretching (n = 25; mean age 49.7 ± 6.5 years; 8 males, 17 females) on first step in the morning pain, average pain at the medial plantar calcaneal region over 24 hours, PPT, ankle dorsiflexion/plantarflexion ROM, and VAS-foot and ankle questionnaire values after four weeks. The Achilles tendon stretch fits within the gastrocnemius/soleus stretching category on this CPG. The results of this study indicated that the Achilles tendon and plantar fascia stretching group showed a significantly greater PPT at four weeks than the Achilles tendon alone (MD, 1.3, *P* = .040). There were no significant differences between the two groups for all other outcomes.

Gastrocnemius/Soleus Stretching

II

A RCT by Lipa et al, [48] compared MFR, US (n = 15; mean age 45.40 ± 3.22 years), and stretching to MFR and US (n = 15; mean age 44.47 ± 3.79 years). The experimental group (n = 15, mean age 45.40 ± 3.22 years) received MFR, US with stretching and the control group received MFR and US (n = 15, mean age 44.47 ± 3.79 years) over 24 sessions in six weeks.

The stretching intervention included gastrocnemius/soleus stretching completed both by the therapist and the patient. The results indicated significantly greater improvement in the pain VAS (*t* = 4.25, *P* = .00) and FFI (*t* = 4.52, *P* = .00) in the group that received stretching added to MFR and US.

Home Stretching Compared to Physical Therapy-based Stretching

III

A RCT by Kaiser et al,[Kaiser 2022] investigated the differences between home based plantar fascia stretching (n = 30; mean age 57 years; 12 males, 18 females) and formal physical therapy (n = 27; mean age 56 years; 6 males,21 females) consisting of plantar and gastrocnemius/soleus stretching in addition to other approaches as needed. The results indicated no statistically significant differences between

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groups for the VAS (0-10), the FAAM ADL & sports subscales, and for the physical component summary and mental component summary scores of the SF-36 questionnaire (*P* > .05).

Evidence Synthesis

The additional studies included in this update add to the body of evidence supporting the existing recommendation. One high quality SR of eight RCTs found that combined gastrocnemius/soleus and plantar fascia stretching was superior to sham and no stretching, plantar fascia stretching was superior to gastrocnemius/soleus stretching, and plantar fascia stretching with ESWT was superior to ESWT alone.

One high quality RCT found that plantar fascia stretching was more effective than oral nonsteroidal anti-inflammatory drugs (NSAIDs), heat therapy and a heel pad, and active gastrocnemius/soleus stretching. One high quality RCT found no effect of gastrocnemius/soleus, plantar fascia, and gastrocnemius/soleus combined with hamstring stretching with and without muscle strengthening exercises on balance. Since balance is not a key target of treatment for plantar fasciitis, this result did not impact the existing recommendation. One high level RCT found no effect of gastrocnemius/soleus, plantar fascia, fibularis, and gastrocnemius/soleus combined with hamstring stretching on pain or function, however, results were only measured one week after treatment. This substantially limited its applicability for this guideline. One high quality RCT and one lower quality RCT supported plantar fascia stretching over gastrocnemius/soleus or foam rolling to improve PPT immediately after treatment. The lack of long-term follow-up limits the applicability of this evidence. Two articles reporting on one RCT found no effect of MPC combined with plantar fascia stretching on heel pain and tenderness, and no correlation between heel pain and plantar fascia thickness. One lower quality RCT supported gastrocnemius/soleus stretching combined with MRF and US over MRF and US alone to improve pain at six weeks. Lastly, one lower quality RCT found no difference in pain and function between home-based plantar fascia stretching compared to plantar fascia and gastrocnemius/soleus stretching in addition to other conventional interventions used in a physical therapy setting.

The evidence supports the effectiveness of plantar fascia-specific and gastrocnemius/soleus stretching exercises for improving pain, function, and disability, with treatment times ranging from one week to twelve months. There were no serious side effects or adverse events that were reported within any of these studies. The only reported side effects were mild to moderate increase in pain while stretching, which ceased at the conclusion of the stretch. There was not enough evidence that isolated the effect of adding hamstring or fibularismuscle stretching to plantar fascia and gastrocnemius/soleus stretching. Therefore, the recommendation was not changed.

Gaps in Knowledge

Future research should investigate long-term outcomes (> 3 months), and isolate the effects of stretching other muscles in conjunction with plantar fascia and gastrocnemius/soleus stretching, such as the hamstring and fibularis. Studies should specify stretching parameters, duration, and frequency of treatment.

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2023 Recommendation

A
Clinicians should use plantar fascia-specific and gastrocnemius/soleus stretching to provide short-term and long-term pain reduction as well as to improve short and long-term function and disability.

Taping

Operational Definitions

Within this review, taping includes the use of rigid (such as athletic or Leukotape) and elastic (Kinesiology or Dynamic Tape®) tape that was applied for any period of time and in any manner to the foot or ankle region of the body. Rigid taping techniques may attempt to provide mechanical support, while elastic tape may attempt to offer support while allowing movement. All tape when applied to the skin may provide afferent input that potetnailly effects efferent responses.

2014 Recommendation

A
Clinicians should use antipronation taping for immediate (up to 3 weeks) pain reduction and improved function for individuals with heel pain/plantar fasciitis. Additionally, clinicians may use elastic therapeutic tape applied to the gastrocnemius and plantar fascia for short-term (1 week) pain reduction.

Evidence Update

I
Two systematic reviews found taping to be an effective short-term treatment for those with plantar fasciitis.[30],[72] The meta-analysis by Guimarães et al. [30] found low-dye taping to significantly decrease pain compared to controls (four studies, n = 231) in the short-term (one to ≤ six weeks) with a MD of -3.60 (95% CI: −4.16, −3.03). A RCT by Castro-Méndez [12] compared Dynamic Tape® to low-dye taping at one week follow-up in 57 subjects (28 women and 29 men) with a mean age of 41.7 SD ± 8.9 years. The Dynamic Tape® significantly decreased pain VAS scores compared to low-dye taping. (MD, -2.05 (95% CI: -2.37, -1.63) versus MD, -1.10 (95% CI: -1.74, -0.47); *P* = .015, eta squared=0.10). However, low-dye taping was able to significantly decrease pronation on the Foot Posture Index-6 (FPI-6) compared to Dynamic Tape® (MD, -0.47 (95% CI: -0.71, -0.22) versus 0.034 (95% CI: -0.08, 0.15); *P* < .001, effect size 0.02).

I
Two studies included in the Schuitema et al. [72]systematic review directly compared taping to ESWT. Ordahan et al, [57] compared a group receiving ESWT (n = 37; mean age 47.8 years; 9 males, 28 females to a group with kinesio taping (n = 33; mean age 47.7 years; 7 males, 26 females) at five-week follow-up. Both groups showed significant improvement (*P* < .05), with no significant differences between ESWT and kinesiology taping on the pain VAS (MD, -3.1 versus -3.8; *P* = .670) and heel tenderness index (MD, -1.3 versus -1.3; *P* = .731) and the five Foot and Ankle Outcome Score (FAOS) subscales (*P* = .3-.673). Tezel et al,[84] investigated the effectiveness of kinesiology taping (n = 36; mean age 46.7 years; 7 males, 29 females) compared with ESWT (n = 42; mean age 46.2 years; 7 males, 35 females) at six weeks follow-up. The results indicated that there was a statistically significant improvement on the pain VAS for both kinesiology taping and ESWT (MD, -2.72; *P* = .001 versus -2.42; *P* = .001). Both groups also had

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significant improvement on seven of the eight Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) subscale scores, including pain (MD, 16.81; *P* = .001 versus 14.92; *P* = .001) and physical function (MD, 13.96; *P* = .004 versus 5.71; *P* = .043) subscales. Only the kinesiology taping group showed a significant decrease on FFI subscales score for pain (MD, -20.17; *P* = .001 versus -4.65; *P* = .075) disability (-20.27; *P* = .007 versus -6.79; *P* = .377) and activity restriction (MD, -28.57; *P* = .001 versus -8.04; *P* = .162).

I

Tulasi Ratna et al, [65] compared a group receiving conventional therapy that consisted of US, plantar fascia and Achilles stretching, and instrinsic foot muscle strengthening to conventional therapy combined with kinesiology taping (n = 45; age range, 20-55 years). Primary findings for the study found a significantly greater improvement at three-week follow-up for patients who received kinesiology taping along with conventional therapy in regards to improvement in VAS pain levels (MD, -2.50 versus -4.69; *P* < .0005) and decreased disability with the Plantar Fasciitis Pain/Disability Scale (MD, -13.39 versus -24.79; *P* < .0005).

II

Three lower level RCTs [42], [61],[38] demonstrated positive effects of kinesiology taping at a two-week follow-up. Kirthika et al. [42] investigated the effectiveness of kinesiology tape application (n = 20) compared to stretching exercises for the plantar fascia and calf muscles (n = 20) on balance and functional performance. At the twoweek follow-up, the mean SEBT (95.98 versus 90.28) and FAAM scores (83.99 versus 72.54) were significantly greater (*P* < .001) in the kinesiology taping group. Rahane et al,[61] also found kinesiology taping and therapy (n = 20) to have improved outcomes at a two week follow-up when compared to a therapy alone group (n = 20). Therapy consisted of US, contrast baths, intrinsic muscle and calf strengthening, plantar fascia and Achilles stretching. Kinesiology taping and therapy had lower two-week pain VAS decrease (-1.25 versus -3.95; *P* < .001) and decreased FFI total score (-22.04 versus -12.13; *P* < .0001). Karishma et al,[38] compared kinesiology taping and stretching to US and stretching in 30 subjects. At the two-week follow-up, the kinesiology tape group had lower pain VAS (1.13 versus 4.2; *t* = -9.92, *P* < .0005) and FADI scores (11.46 versus 39.46; *t* = -19.32, *P* < .0005).

II

Two lower level RCTs [78], [83] compared taping to manual therapy techniques. Solanki [78] investigated the effectiveness of a taping technique aimed at stabilizing the foot compared to calcaneal glide mobilizations in 30 subjects with symptoms of greater than three months in duration. While both groups significantly improved (*P* < .05), the taping group improved significantly more on the pain VAS (*t* = 1.821, *P* < .05) and FFI total score (*t* = 1.830, *P* < .05). Tariq et al, [83] compared a calcaneal taping technique to a muscle energy technique aimed at increasing dorsiflexion ROM in 52 subjects (46.2% males, 53.8% females, 19.2% between the age 20-30 years, 34.6% between 31-40 years, 30.8% between 41-50 years and 15.4% between 51-60 years). Both groups received seven treatments on alternate days that also included US, foot intrinsic muscle strengthening exercises, tibialis anterior stretching exercises. After the seven treatments, both groups improved, with the taping groups having lower FFI scores (13.53 ± 5.25 versus 21.27 ± 9.30 *P* = .001) and lower pain on the VAS (1.42 ± 0.758 versus 2.92 ± 1.354, *P* < .0005)

Evidence Synthesis

Two systematic reviews continue to support the use of taping for short-term (one to ≤ six weeks) pain relief. Two types of taping techniques have been studied, a rigid low-dyetaping technique that aims to

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provide mechanical support and an elastic tape that offers dynamic support along with other proposed positive effects (decreasing pain). One level I study favored the elastic form of taping over the rigid form for decreased pain at one week. Another level I study found there was a greater improvement in pain and disability for patients who received kinesiology taping along with conventional therapy at three weeks. Lower level RCTs have supported the use of elastic taping in short-term (two week) outcomes with improved pain and function when compared to stretching or manual therapy alone or when taping was added to other physical therapy interventions. Two RCTs have found no difference between kinesiology taping and ESWT in decreasing pain in follow-up ranging from immediately posttreatment to a six-week follow-up. Only one of the three studies found results for function that favored kinesiology taping over ESWT. The only reported harm reported related to taping has been mild skin irritation. Therefore, the benefits of taping outweigh the potential harm.

Gaps in Knowledge

Further studies are needed to directly compare rigid versus elastic taping as well as compare methods of tape application. Additionally, studies investigating long-term outcomes (> six weeks) are needed.

2023 Recommendation

A
Clinicians should use foot taping techniques, either rigid or elastic, in conjunction with other physical therapy treatments for short-term (one to ≤ six weeks) improvements in pain and function in individuals with plantar fasciitis.

Foot Orthoses

Operational Definitions

Within this review foot orthoses included any external support applied to the foot (in-shoe) or ankle (ankle-foot orthotic) made of any material with the general purpose of supporting the medial longitudinal arch and offloading the plantar fascia. Foot orthoses may include either custom or prefabricated varieties.

2014 Recommendation

A
Clinicians should use foot orthoses, either prefabricated or custom fabricated/fitted, to support the medial longitudinal arch and cushion the heel in individuals with heel pain/plantar fasciitis to reduce pain and improve function for short- (2 weeks) to long-term (1 year) periods, especially in those individuals who respond positively to antipronation taping techniques.

Evidence Update

I
This update includes three systematic reviews with meta-analyses [31], [63], [88], one systematic review without a meta-analysis,[72], and one comparative effectiveness systematic review with meta- analysis [9] that collectively provide a more conservative impression of the benefits of orthoses compared to the previous review, particularly as an isolated treatment in the short-term. The meta-analysis by Guimares [30] found no significant effect for pain reduction when orthoses were compared with controls (including

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either sham or flat orthoses) at one to six weeks (four studies, n = 259, pooled MD, −0.6 (95% CI: −1.74, 0.56); *P* = .31) and seven to 12 weeks (5 studies, n = 396 pooled MD, −0.74 (95% CI: −1.49, 0.02); *P* = .06) follow-up. Additionally, this review found no significant effect for pain reduction when custom and prefabricated orthoses were compared at one to six weeks (three studies, n = 304, pooled MD (−1.07 (95% CI: −3.26, 1.11); *P* = .34) and seven to 12 weeks (four studies, n = 465 pooled MD (−0.11 (95% CI: −0.69, 0.60); *P* = .72) follow-up.

II

Not included in the systematic reviews, a lower level RCT by Çaglar Okur et al,[10] investigated the differences between custom orthoses (n = 43; mean age 46.94 years; 8 males, 35 females) and ESWT (n = 40; mean age 48.84 years; 7 males, 33 females) on four pain VASs (at rest, walking, morning and evening), FFI total score, and the eight subscales of the FHSQ. There were no significant differences between the ESWT and custom foot orthoses groups at four-week follow-up (*P* > .05). Twelve weeks after treatment, the physical activity subscale of FHSQ was significantly different in favor of the custom foot orthotic (CFO) group (*P* < .05). Twenty four weeks after treatment there was a significant difference (all comparisons *P*< 0.05) in evening pain VAS (CFO 4.7 vs ESWT 5.9), and on the foot pain (CFO 60.2 vs ESWT 551.2), foot function (CFO 80.2 vs ESWT 70.5), general foot health (CFO 40.6 vs ESWT 32.6), and physical activity subscales (CFO 71.4 vs ESWT 61.6) of the FHSQ in favor of the custom orthosis group (*P* < 0.05). Forty-eight weeks after use of either CFO or ESWT, there was a significant difference (all comparisons *P* < .001) in pain VAS with walking (4.1 SD ± 1.7 versus 5.5 SD ± 2.1) and evening pain VAS scores (4.5 SD ± 1.7 versus 6.2 SD ± 2.1), and FFI total scores (51.8 SD ± 18.1 versus 66.4 SD ± 21.1) as well as on the foot pain (40.4 SD ± 19.3 versus 56.2 SD ± 22.1), foot function (73.3 SD ± 16.9 versus 54.3), and physical activity (70.1 SD ± 21.8 versus 58.7 SD ± 20.9) subscales of FHSQ in favor of the CFO group.

II

Included in the Guimarães [31] review, a lower level RCT by Coheña-Jiménez et al,[16] investigated the differences between custom-made foot orthoses with ESWT and posterior muscle chain stretching versus placebo flat cushioning insoles with ESWT and posterior muscle chain (plantar and gastrocnemius) stretching (n = 76; mean age 36.5 years; 35 males 41 females). The VAS scores after one month were significantly different between the custom orthoses (experimental) group and the placebo (control) group (3.41 [95% CI: 2.5, 4.4] versus 7.26 [95% CI: 6.3, 8.3]; *P* = .0001, effect size: d=3.37) in favor of the custom orthoses group. The VAS scores at six months were also significantly different between the experimental and the control group (3.29 [95% CI: 2.3, 4.3] versus 7.52 [95% CI: 6.1, 8.5]; *P* = .0001, effect size: d=3.46), again in favor of the custom orthoses group.

Evidence Synthesis

The evidence from new meta-analysis suggested a small to no effect of the use of custom or prefabricated orthoses as a stand-alone treatment for the short-term (< 3 months) management of plantar fasciitis. New studies investigating the additive benefit of orthoses to a multi-modal program on long-term outcomes are limited. When combined with other interventions, such as stretching and ESWT, the outcomes on pain are positive. Additionally, a level II study found long-term (24-28 weeks) follow-up favored custom orthoses over ESWT on pain and function.

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Gaps in Knowledge

Evidence on the type, materials, and design of foot orthoses is limited, while evidence clearly finds a similarity in outcomes between custom and prefabricated orthoses. Studies looking at the additive benefit of orthoses to a multi-modal program on long-term outcomes are needed.

2023 Recommendation

B
Clinicians should not use orthoses, either prefabricated or custom fabricated/fitted, as an isolated treatment for short-term pain relief in individuals with plantar fasciitis.

C
Clinicians may use orthoses, either prefabricated or custom fabricated/fitted, when combined with other treatments in individuals with heel pain/plantar fasciitis to reduce pain and improve function.

Night Splints

Operational Definition

Night splints are prefabricated plastic orthoses that are used to prevent ankle plantar flexion while sleeping.

2014 Recommendation

A
Clinicians should prescribe a 1- to 3-month program of night splints for individuals with heel pain/plantar fasciitis who consistently have pain with the first step in the morning.

Evidence Update

No studies investigated the effectiveness of night splints. Therefore, the recommendation is unchanged.

2023 Recommendation

A
Clinicians should prescribe a 1- to 3-month program of night splints for individuals with heel pain/plantar fasciitis who consistently have pain with the first step in the morning.

Physical Agents - Electrotherapy

2014 Recommendation

D
Clinicians should use manual therapy, stretching, and foot orthoses instead of electrotherapeutic modalities to promote intermediate and long-term (1–6 months) improvements in clinical outcomes for

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individuals with heel pain/plantar fasciitis. Clinicians may or may not use iontophoresis to provide short-term (2–4 weeks) pain relief and improved function.

Evidence Update

Level I
A RCT by Razzano et al,[66] compared non-invasive interactive neurostimulation (n = 59; mean age: 53 years; 30 males, 29 females) and ESWT (n = 55; mean age: 50.6 years; 23 males, 32 females) on the PS-FFI, all pain outcomes were measured by the VAS (0-100), and daily intake of Etoricoxib (60 mg). The non-invasive interactive neurostimulation group had a significant effect of treatment ($P < .031$) compared to ESWT for all outcomes after four and twelve weeks with moderate effect sizes for all outcomes.

Level II
A RCT by Ge et al,[26] compared the effects of dry cupping (n = 14; mean age 40.1 ± 14.6 years; 4 males, 10 females) to pre-modulated interferential current electrical stimulation (n = 15; mean age 39.3 ± 13.5 years;10 males, 5 females) on pain (VAS 0-100), FAAM, LEFS, and PPT. The VAS (0-100 cm) had mean differences (at rest, first in the morning, and with activities) of −29.8 mm (95% Cl: −39.4, −20.1) in the dry cupping therapy group compared to −28.0 mm (95% Cl: −36.7, −19.2) in the electrical stimulation therapy group. The FAAM, had mean differences of 16.9 (95% Cl: 7.8, 26.0) % in the dry cupping therapy group compared to 12.9 (95% Cl:8.2, 17.6) in the electrical stimulation therapy group**.** The LEFS, had mean differences of 19.6 (95% Cl:8.6, 30.7) in the dry cupping therapy group compared to 11.4 (95% Cl:7.7, 15.1) in the electrical stimulation therapy group. The PPT, had mean differences of 4.6 (95% Cl: 0.0, 9.1) lb in the dry cupping therapy group compared to 1.7 (95% Cl: −2.7, 6.0) lb in the electrical stimulation therapy group. There were no significant differences ($P >.05$) between the two groups in all outcome measures after four weeks.

Level II
A RCT by Srivastava et al,[80] compared the effectiveness of iontophoresis added to conventional therapy (n = 20) to conventional therapy alone (n = 20) which consisted of ankle/foot exercises, stretching, and US on the VAS (0-10) and FFI. The VAS had statistically significant differences between the iontophoresis with the conventional therapy group ($t = .765$, $P = .000$). The FFI had statistically significant differences between the iontophoresis with the conventional therapy group, $t = 3.369$, $P = 0.003$). Iontophoresis with conventional therapy was more effective than conventional therapy alone on pain and function over two weeks (6 sessions per week), with moderate estimates of effect on the MCIDs for all outcome measures.

Level II
A RCT by Das and Dutta [18] compared the benefit of interferential therapy with conventional therapy (n = 15) to conventional therapy alone (n = 15) which consisted of US, a contrast bath, stretching of the plantar fascia and Achilles, and strengthening exercises for the intrinsic muscles of the foot on VAS (0-10), FFI, and dorsiflexion ROM. Interventions spanned 15 days (3 sessions per week). Interferential therapy with conventional therapy was superior to conventional therapy alone for VAS ($t = 4.638$, $P = .00$) and FFI ($t = 4.38$, $P = .00$). Dorsiflexion ROM effects were not significant, (t = - .642, $P = .526$).

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Evidence Synthesis

One level II RCT found no difference in pain and function between pre-modulated interferential current electrical stimulation and dry cupping. One high quality RCT supported Non-invasive Interactive Neurostimulation over ESWT, with a small to moderate effect size, to improve pain and daily intake of Etoricoxib at four and twelve weeks. One level II RCT supported iontophoresis with conventional therapy. One level II RCT supported interferential therapy with conventional therapy, however, both with small effects. Follow-up times varied among these studies from two to 12 weeks. There were no adverse effects. Therefore, the estimates of effects from these studies were small and there was low confidence in their precision. Therefore, the main recommendation, to use other evidence-based interventions versus electrotherapy, has not changed. Because of the low-level evidence available for the effect of pre-modulated interferential current electrical stimulation, this intervention was added to the second recommendation statement.

Gaps in Knowledge

Future research should investigate the effects of iontophoresis and pre-modulated interferential current in studies with sufficient sample sizes to provide more confidence in the estimates of effect.

2023 Recommendation

D

Clinicians should use manual therapy, stretching, and foot orthoses instead of electrotherapeutic modalities to promote intermediate and long-term (1–6 months) improvements in clinical outcomes for individuals with heel pain/plantar fasciitis. Clinicians may use iontophoresis or pre-modulated interferential current electrical stimulation as a second line of treatment.

Physical Agents - Low-Level Laser Therapy

2014 Recommendation

C

Clinicians may use low-level laser therapy to reduce pain and activity limitations in individuals with heel pain/plantar fasciitis.

Evidence Update

I

Five systematic reviews came to similar conclusions finding a positive effect for low level laser therapy (LLLT) on decreasing pain in those with plantar fasciitis [31],[87],[21],[56],[30]. A total of 14 studies (n = 817) on LLLT were included in the most recent meta-analysis by Guimarães [30]. This analysis identified five studies (n = 231) that found LLLT improved pain compared to a control, with a MD of − 2.09 (95% CI: -2.28, −1.90) in a short-term follow-up (one to ≤ six weeks). Also, LLLT was compared to ESWT in four studies (n = 175) and HILT in two studies (n = 172) with no significant difference between the treatments in the short-term (one to ≤ six weeks) with pooled MD of 0.5 (95% CI: -2.0 2.9) and -0.47 (95% CI: -2.81, 1.87), respectively.[30] Another meta-analysis found two studies (n = 90) where LLLT combined with rehabilitation improved pain with a MD of -2.0 (95% CI: -2.9, -1.1) in the short-term (zero to ≤ six weeks)

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when compared to rehabilitation alone.[30]The meta-analysis by Wang et al,[87] found the VAS score to be better in the LLLT group three months after treatment (SMD, -1.13; 95% CI: -1.53, -0.72; P < .001) compared to controls.

II
When looking at disability, the systematic review by Guimaraes et al. [30] identified three lower quality studies (n =190) and concluded that there was no significant difference in short-term disability when LLLT was compared to a placebo with a mean difference of −10.0 (95% CI: −26.2, 6.2). Similar findings were noted in other systematic reviews.[87],[21]

II
Not included in the systematic reviews, a lower quality RCT by Lamba et al. [44] compared LLLT (780nm; 10J/cm^2) and plantar fascia stretching (n = 40; mean age, 45.88 years) to sham LLLT and stretching LLTT (n = 40; mean age, 45.42 years). From baseline to week four follow-up there was a significant decrease in pain on the VAS (-3.20 versus -0.83; *P* = .004), decrease in disability on the FFI (-32.87 versus -8.97; *P* < .0005), and increase ankle dorsiflexion ROM (5.13 versus 2.48; *P* = .005) in the LLLT group.

II
Another lower level RCT compared a group receiving LLLT (n = 20; mean age, 46.8 years; 8 males, 12 females) to a group receiving ESWT (n = 27; mean age 46.9 years; 1 male, 26 females) and found more subjects in the LLLT group achieved a clincialy improtant difference on the FFI for pain (95% n = 19 versus 48% n = 13), activity limitation (80% n = 16 versus 19% n = 5), and disability (80% n = 16 versus 33% n = 9).[86]

Evidence Synthesis

The evidence from high quality meta-analyses found that LLLT used alone or with other interventions provided a small improvement in pain in the short-term (1-3 months) in those with either acute or chronic plantar fasciitis. The body of evidence did not consistently support LLLT on improving disability. However, this evidence was of lower quality and conflicting. The evidence to support LLLT over ESWT was also conflicting. The meta-analyses noted that the LLLT treatment parameters applied in studies were varied or poorly reported. Studies that used the World Association for Laser Therapy (WALT) recommendation, treating two to three points with a minimum dose of 2 J/point with a 904 nm wavelength laser or 4 J/point with 780–860 nm wavelength laser, produced positive outcomes. [56] In studies the typical treatment duration was three times per week for three weeks. No harms were reported for LLLT treatment.

Gaps in Knowledge

The optimal LLLT treatment parameters, including wavelength, energy dosage, duration, and frequency need to be further studied. Also, higher quality research is needed to further investigate the effect of LLLT on foot function.

2023 Recommendation

B
Clinicians should use LLLT as part of a rehabilitation program in those with acute or chronic plantar fasciitis to decrease pain in the short-term.

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Physical Agents - Phonophoresis

2014 Recommendation

C
Clinicians may use phonophoresis with ketoprofen gel to reduce pain in individuals with heel pain/plantar fasciitis.

Evidence Update

No studies investigated the effectiveness of phonophoresis. Therefore, the recommendation is unchanged.

2023 Recommendation

C
Clinicians may use phonophoresis with ketoprofen gel to reduce pain in individuals with heel pain/plantar fasciitis.

Physical Agents - Ultrasound

2014 Recommendation

C
The use of ultrasound cannot be recommended for individuals with heel pain/plantar fasciitis

Evidence Update

I
Katzap et al. [40] compared US and stretching (n = 28; mean age 50.93 ± 12.87 years; 21.4% male, 78.6% female) to sham US and stretching (n = 26; mean age 52.58 ± 12.36 years; 46.2% male, 53.8% female). Ultrasound was performed at 1 MHz, 1.8 W/cm^2, and continuous current for 8 minutes to potentially maximize both thermal and non-thermal effects. Both groups received US treatments in addition to plantar fascia and the triceps surae stretching twice a week for four weeks. No significant differences were found for pain level during the day (MD, 0.01 95% CI: -1.07, 1.09), self-reported function on a foot and ankle computerized adaptive test (MD, 1.44 95% CI: -3.61, 6.49) and PPT (MD, 0.11kg 95% CI: -0.82, 1.04).

I
Two meta-analyses compared US treatments to ESWT.[5], [45] The most recent one by Al-Siyabi et al. [5] identified seven studies with a total of 369 subjects and found no difference in functional impairment (MD, −2.90; *P* = .22), on the AOFAS ankle-hindfoot scale (MD, 35; *P* = .20), and for pain with the first steps in the morning (MD; −4.72, *P* = .39). However, there was a significant improvement in pain during activity for the ESWT group (MD, −1.36; *P* = .005).

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II

A lower level RCT with 82 subjects (37 males, mean age 38.59 ± 7.06 years; 45 females, mean age 38.32 ± 6.6 years), and those receiving seven US treatments (3 MHz at 1.0 w/cm^2, continuous for 7 mins) with sham taping were compared to those receiving seven ESWT treatments over a 35 day period. The group receiving ESWT had significantly less pain compared to the US group (1.54 SD ± 0.67 versus 2.6 SD ± 0.64; *P* = 0.001) at the end of the treatment sessions.[34]

Evidence Synthesis

Two RCTS investigated the effect of ultrasound compared to a control. The other RCT found that that standard ultrasound treatment did not enhance the effect of stretching exercises. Other studies have compared ESWT to ultrasound treatments. It was noted that individuals receiving either ESWT or ultrasound may both show improvement with ESWT having a benefit over ultrasound in improving pain during activity. No harms of ultrasound treatment have been reported.

Gaps in Knowledge

There lacks high quality research for optimal US treatment parameters, including wavelength (W/cm^2), frequency , and duration of treatment for acute and chronic plantar heel pain.

2023 Recommendation

A

Clinicians should not use ultrasound to enhance the benefits of stretching treatment in those with plantar fasciitis.

Physical Agents: Thermal

2014 Recommendation

None

Evidence Update

II

In a lower level RCT, Petrofsky et al. [58] investigated the effects of local heat applied to trigger points compared to sham heat on pain measured by a VAS and tenderness thresholds measured with a handheld pressure algometer (n = 20; mean age 49.1 ± 11.7 years). Local heat was applied via ThermaCare back wraps (ThermaCare, Pfizer Consumer Healthcare, Richmond, VA, USA), where four cells treated the medial and lateral gastrocnemius motor points at a temperature of 41°C ± 0.5 for four hours. Immediately after the four-hour treatment, the heating group had a decrease in pain from 53.91mm SD ± 21.32 to 30.13mm SD ± 26.81 (*P* < .001) while the sham group changed from 53.91mm SD ± 21.32 to 52.30mm SD ± 23.42 (*P* = .868). For tenderness thresholds there was a significant difference in change in pressure threshold with the heat treatment increase in tenderness threshold (21.06 ±11.38 N to 29.84 ± 14.72 N, *P* < 0.01) while the sham group decreased in pressure threshold.(21.06N SD 11.38 to 14.11N SD 7.71, *P* =.022)

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Evidence Synthesis

A single level II study supported the use of local heat applied for four hours to trigger points, using a specialized device that maintains a safe temperature, to decrease local pain and improve pressure thresholds immediately after treatment. Because this treatment was applied for four hours it may be more relevant for a home intervention as opposed to being performed in a clinic. No harms of this thermal treatment were reported.

Gaps in Knowledge

Other areas that need to be studied include the effect of local heat on other outcomes when combined with other interventions, as well as if application parameters, such as frequency and duration, that are friendlier to clinical practice would produce similar outcomes.

2023 Recommendation

C
Clinicians may recommend the application of local heat applied for four hours to trigger points in the gastrocnemius/soleus, using a specialized device that maintains a safe temperature, for immediate decrease in local pain and improvement in pressure thresholds in those with plantar fasciitis.

Education and Counseling for Weight Loss

2014 Recommendation

E
Clinicians may provide education and counseling on exercise strategies to gain or maintain optimal lean body mass for individuals with heel pain/plantar fasciitis. Clinicians may also refer individuals to an appropriate health care practitioner to address nutrition issues.

Evidence Update

There were no articles addressing this topic.

2023 Recommendation

E
Clinicians may provide education and counseling on exercise strategies to gain or maintain optimal lean body mass for individuals with heel pain/plantar fasciitis. Clinicians may also refer individuals to an appropriate health care practitioner to address nutrition issues.

Therapeutic Exercise and Neuromuscular Re-education

Operational Definitions

Below we provide operational definitions of the terms used in this section (Table 4).
TABLE 4. Operational Definitions for Therapeutic Exercise and Neuromuscular Re-Education Interventions

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Intervention	Operational Definition
Muscle strengthening and endurance	Exercise training prescribed to restore strength, endurance, or power of muscle groups associated with plantar heel pain.
Specific muscle activation exercises	Exercise training prescribed to restore the strength, endurance, or power of specific muscles including but not limited to toe flexors, ankle inverters, ankle everters, ankle plantar flexors and ankle dorsiflexors.
Eccentric exercise	Exercise training that focuses on muscle contraction during lengthening.
Concentric exercise	Exercise training that focuses on muscle contraction during shortening.
Isometric exercise	Exercise training that focuses on muscle contraction at a specific length.
Neuromuscular re-education	Exercise training prescribed to restore normal body movement patterns by retraining the central nervous system involuntary and reflex motor activities.

2014 Recommendation

F

Clinicians may prescribe strengthening exercises and movement training for muscles that control pronation and attenuate forces during weight-bearing activities.

Evidence Update: Strengthening

Level I

A high quality RCT by Thong-On et al,[85] compared the effects of strengthening (n = 42; mean age, 51.95 ± 10.10 years; 13 males, 29 females) and stretching exercise (n = 42; mean age, 52.86 ± 9.84 years; 9 males, 33 females) programs on pain and temporospatial gait parameters at baseline and six weeks. Strengthening focused on toe flexor, ankle invertor/evertor, and gastrocnemius exercises. Stretching focused on gastrocnemius, soleus, and plantar fascia. Primary outcomes included worst and morning pain measured by number of first steps with pain. The secondary outcomes were gait cadence, step width, stride length, stride time, total double support time, and gait speed. For the primary outcomes, pairwise comparisons were significant ($p < .0001$) at all time points and for both groups indicating positive effects of the intervention. There were no significant differences between the groups, at in any of the outcomes at any of the timepoints.

Level I

In a high quality RCT, Rathleff et al,[64] investigated the difference between high load strength training (n = 24; mean age, 45 ± 8 years; 8 males, 16 females) and stretching (n = 24; mean age, 47 ± 7 years; 9 males, 15 females) The primary outcome was total change in FFI from baseline to a three-month follow-up. Secondary outcomes included measurement of plantar fascia thickness using ultrasound with the subject in prone, ankle at 0 degrees and toes in dorsiflexion, item 1 in the FFI (foot pain at worst) and

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item two (foot pain during first step in the morning), patient reported satisfaction with the result of the treatment, physical activity level measured in terms of average time of sports participation, and average leisure time sports participation per week. At the primary endpoint (3 months), the authors found the strength group had a significantly greater improvement in FFI (MD 29, 95% CI: 6, 52; *P* = .016) compared with the stretching group, corresponding to a large effect size of 0.81. Patients in the high-load strength training group reported significantly less foot pain (MD −2.6 (−4.6; −0.6); *P* < .05)at the primary endpoint. At twelve months, the change in the strength group FFI total score was 22 points (95% CI: 9, 36; *P* < .05). The stretch group showed a change of 16 points (95% CI: 0, 32; *P* < .05)

Level I

A RCT by Reil et al,[68] investigated the effectiveness of a self-dosed heavy-slow resistance training program (n = 35; mean age, 50 ± 10 years; 6 males, 29 females) compared to a predetermined heavy-slow resistance training program (n = 35; mean age, 49 ± 12 years; 6 males, 29 females) over twelve weeks. The self-dosed group was instructed to perform strengthening exercises as heavily as possible, but no heavier than 8 repetition maximum (RM), with a maximum tolerated number of sets and resistance. The parameters for the self-dosed group were to perform the exercise according to a standardized protocol progressing from 12RM to 8RM. Both groups performed standing heel raises every other day, and were provided patient education and a silicone heel cup, which was continued for twelve weeks. The primary outcome measure for this study was the change in FHSQ scores. The secondary outcomes were the function, footwear, and general health domains for the FHSQ, change in Global Rating of Change (GROC), plantar fascia thickness measured using ultrasound, with the subject in prone and the toes in maximal dorsiflexion, exercise compliance, the Pain Self-Efficacy Questionnaire, Patient Acceptable Symptom State, and physical activity level measured by the International Physical Activity Questionnaire short version. There was no significant between-group difference in the FHSQ pain after twelve weeks (adjusted MD 27 points, 95% CI: -16, 2). The self-dosed heavy-slow resistance training program did not reduce pain more than a predetermined heavy-slow resistance training program that had previously been shown to be effective.

Level I

A high quality RCT by Cil et al, [14] investigated supervised exercise for foot, ankle, and hip strengthening combined with modalities to a home foot, ankle and hip strengthening program. The participants in the supervised rehabilitation group (n= 23; mean age, 48.1 years; 5 males, 18 females) performed an exercise program including foot, ankle, and hip strengthening and stretching exercises (7 days/wk), myofascial release, joint and soft tissue mobilization (2 days/wk) under the supervision of the same physiotherapist for a duration of eight weeks. The participants in the home rehabilitation group (n= 24; mean age, 49.6 years; 7 males, 17 females) were instructed to perform the HEP foot and ankle-hip strengthening and stretching exercises for 7 days/wk. The primary outcome was the FFI. Secondary outcomes included: morning first-step pain, the Y-Balance test, passive ankle ROM, and monofilament testing. Measurements were taken at baseline, after the intervention at eight weeks and then at six months. The supervised rehabilitation group showed moderate improvements in the FFI with a mean improvement of 66.6 (SD ±15.4), while the home rehabilitation group improved 26.9 (SD ±12.5). Moderate improvements between timepoints persisted on the VAS with the supervised exercise group showing a change of 7.3 (SD ±1.4), and the home rehabilitation group showing a change of only 3.1 (SD±1.4)

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Level I
A high quality RCT by McClinton et al,[51] investigated the effectiveness of physical therapy treatment with usual podiatry management (uPOD+PT, n= 41; mean age, 50.9 ± 10.1 years; 12 males, 29 females) compared to usual podiatry management alone (uPOD, n = 38; mean age, 51 ± 11 years; 8 males, 30 females) over a six week period. The uPOD group received treatment that was performed in accordance with usual practice patterns of the providers, which included education about the diagnosis, recommendations for supportive shoes, medication and/or foot orthoses, provided a handout that emphasized calf and plantar foot stretches, and had the option to refer patients to a physical therapist or to order further imaging. The uPOD+PT group received the same treatment as the uPOD group with a combination of manual therapy, patient education, stretching, resistance training, and neurodynamic interventions. The primary outcome was the FAAM ADL subscale measured at six weeks. Secondary outcomes included the FAAM at six weeks and one year, the NPRS, and the GROC measured at six weeks, six months, and one year. There were small but insignificant between-group differences in the FAAM at the six week (5.1 (-0.7 tp 11.0); *P* = .084) and one year follow up (5.5 (0.1 tp 10.8); *P* = .045) .

Level II
A moderate quality RCT investigated standard care (n=35; mean age, 40.60 ± 10.64 years; 18 males, 17 females) versus a single, US guided corticosteroid injection to the plantar fascia (n=35; mean age, 41.43 ± 9.66 years; 11 males, 24 females).[20] Standard care included a physiotherapist-led strengthening, stretching and neuromuscular re-education program and a custom orthotic. The injection group consisted of a single methylprednisolone injection and a daily routine of calf stretches. Primary outcome measures included the FADI, the VAS and plantar fascia thickness. Plantar fascia thickness was measured using ultrasound, in the prone position with, the ankle positioned at 90 degrees Between group statistics were not reported. The authors found no differences between the groups.

Evidence Synthesis

The prior recommendation was based on expert opinion. Since the 2014 publication, multiple RCTs have been added to the body of literature. There is strong evidence that combined interventions of manual therapy, patient education, stretching, resistance training, and neurodynamic interventions improve pain at six weeks (short term) and one year (long term) and functioning at six months. There is weak evidence that isolated strengthening interventions such as isotonic, isometric, or self-paced walking during three sessions over two weeks provide clinically important pain reduction. There was insufficient evidence to identify a superior type of strength training or exercise.

Gaps in Knowledge

Additional research is needed to determine the dose and timing of the exercise intervention. There also appears to be an additive effect when exercise is combined with other interventions. Additional research is also needed to determine which combinations are best and at which dosages.

2023 Recommendation

C
Clinicians should prescribe therapeutic exercise that includes resistance training for the musculature of the foot and ankle.

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Dry Needling

Operational Definitions

Dry needling is an intervention that uses a thin filiform needle to penetrate the skin and stimulate underlying myofascial trigger points and muscular and connective tissues for the management of pain and movement impairments.

2014 Recommendation

F
The use of trigger point dry needling cannot be recommended for individuals with heel pain/plantar fasciitis.

Evidence Update

I
Llurda-Almuzara et al. [47] performed a meta-analysis of six identified RCTs. The analysis included a total of 395 subjects with symptoms of pain for more than one month, 65% women, and ages ranging from 39 to 54 years. Trigger point dry needling (DN) was found to reduce pain in the short-term with MD of -1.70 points (95% CI: -2.80, -0.60) and standardized MD of -1.28 (95% CI: -2.11, -0.44). In the long-term (up to 6-months), trigger point DN was found to reduce pain with MD of -1.77 points (95% CI: -2.44, -1.11), standardized MD of -1.45 (95% CI: -2.19, -0.70) and related disability with standardized MD of -1.75 (95% CI: -2.22, -1.28). Four other SRs noted similar findings [35], [4],[79],[30]The SR by Sousa Fiho et al. directly compared corticosteroid injection (CSI) to DN and found that while CSI appeared to be superior to DN in the short-term, DN appeared to be more effective in the long-term. The most recent meta-analysis by Guimaraes et al. [30] specifically looked at pain reduction in three studies (n = 215) that compared DN to a control group. This analysis concluded DN was effective in decreasing pain in the short-term (1 to ≤ 6 weeks) with a MD of −2.34 (95% CI: −4.64, −0.04).

I
Moosaei Saein et al. [53] compared DN (n = 10; mean age 51.40 ± 5.46 years) to no treatment (n = 10; mean age 49.40 ± 4.99 years) in 20 women, measuring pain (using what?) and DF/PT ROM (state active or passive). There was a significant difference between the two groups (*P* = .001) at four weeks for change in pain levels of (MD-1.35 (SD ± 0.286). There were no differences with changes in dorsiflexion (MD, -2.1, SD ± 0.917; *P* = .103) or plantarflexion (MD, 1.55 SD 1.16; *P* = .59) ROM between both groups.

I
Salehi et al. [71] investigated the effects of DN and stretching exercise (n = 19; 20 feet, mean age 40.20 ± 4.94 years: 6 males,13 females) versus stretching exercise only (n = 18; 20 feet, mean age 41 ± 6.28 years; 6 males, 12 female) on first step pain and the FOAS pain and ADL subscales. After six weeks of treatment, the combination of DN and stretching exercise group demonstrated significant improvements in pain during the first step in the morning (SMD, −1.7, 95% CI: −2.12, −1.3; Cohen's *d* = -2.67), on the FOAS pain subscale (SMD, 20.06, 95% CI: 15.87, 24.25; Cohen's *d* = -3) and FOAS ADL subscale (SMD, 14.22, 95% CI: 10.15, 18.30; Cohen's *d* = 2.24), with large effect sizes.

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I

Included in meta-analysis by Guimaraes et al. [30], a study by Dunning et al. [22] compared function and disability in a group that received electrical DN with manual therapy, exercise and US (n = 58; mean age 39.1 ±10.4 years; 21 males, 37 females) to a control group that received manual therapy, exercise, and US only (n = 53; mean age 42.6 ±11.6 years; 27 males, 26 females). Those who received the addition of electrical DN experienced significantly greater improvements (P ≤ .004), with a small to medium effect size for SMD (0.32< SMD< 0.55) at four weeks and medium effect size (0.53< SMD< 0.66) at three months on the LEFS, FFI total, and all of the FFI subscales scores. The point estimates for between-group differences at three months were as follows: LEFS 9.26 points; FFI Pain 13.9%; FFI Disability 12.0%; and FFI Total 9.9%. All of these point estimates exceeded their respective MCID values.

I

Dunning et al,[22] compared function and disability in a group that received electrical DN with manual therapy, exercise, and US (n = 58; mean age 39.1 ±10.4 years; 37 males, 21 females) to a control group that received manual therapy, exercise, and US only (n = 53; mean age 42.6 ± 11.6 years; 27 males, 26 females) [22] The results found those who received the addition of electrical DN experienced significantly greater improvements (P ≤ .004), with a small to medium effect size for SMD (0.32 < SMD < 0.55) at 4 weeks and medium effect size (0.53 < SMD < 0.66) at 3 months on the LEFS, FFI total, and all of the FFI subscales scores. The point estimates for between-groups difference at 3 months were as follows: LEFS 9.26 points; FFI Pain 13.9%; FFI Disability 12.0%; and FFI Total 9.9%. All of these point estimates exceeded their respective MCID values.

II

A group receiving DN and stretching (n = 51; mean age 49.5 ± 8.9 years; 15 males, 36 females) was compared to a group receiving percutaneous needling electrolysis and stretching (n = 51; mean age 48.1 ± 8.8 years; 15 males, 36 females) in a lower level RCT.[4] While both interventions were found to be effective in reducing pain and improving function at five time points between four and 52 weeks on the four FHSG subscales and pain VAS, a significant difference was not found between groups (*P* < .061, effect size range 0.001 - 0.035)

Evidence Synthesis

Five SRs that included a total of seven RCTs and three additional RCTs (two of high quality) supported the use of DN to treat MTrPs associated with plantar fasciitis/heel pain, particularly in chronic heel pain (> 1 month). Evidence supports DN as an effective treatment for short- and long-term pain reduction, as well as long-term improvements in function and disability. The number of DN sessions typically ranged from one to six sessions, with treatment being directed to a MTrP in the gastrocnemius, soles and plantar muscles. Although one study found DN was effective as a stand-alone treatment in reducing pain, DN has typically been included with other treatments such as stretching and manual therapy. Reported harms have included post-needling soreness and subcutaneous bleeding, however, these have been considered mild and have resolved spontaneously.

Gaps in Knowledge

Further research is needed to determine if the addition of electrical stimulation and specific parameters of stimulation adds any additional benefit. Currently, only one study has compared standard DN to percutaneous needling electrolysis with equivocal results.

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2023 Recommendation

B
Clinicians should use dry needling to MTrP in the gastrocnemius, soles and plantar muscles for short- and long-term pain reduction as well as long-term improvements in function and disability.

Multimodal Interventions

Operational Definition

A combination of interventions that may include education, manual therapy, neuromuscular re-education, therapeutic exercise, electrotherapeutic modalities, ultrasound, thermal agents, taping, orthotics, splinting, dry needling, or training for correction of posture and movement during functional activities can collectively be considered multimodal intervention. Education may include information about the health condition or activity modification. [24]

2014 Recommendation

None

Evidence Update

I
In a systematic review with network analysis Babatunde et al, [9] included thirty-one RCTs (total n = 2450 patients). Available evidence does not suggest that any of the commonly used treatments for the management of plantar heel pain are better than any other, although CSIs, alone or in combination with exercise, and ESWT were ranked most likely to be effective for the management of short-term, medium-term and long-term pain or function. Placebo or control conditions appeared least likely to be effective; and exercise appeared to only be beneficial for long-term pain or function. Of the direct comparisons of combined treatments CSI combined with exercise showed a statistically significant larger reduction in pain compared with exercise alone (SMD, 1.20, 95% CI: 0.14, 2.26). General trends from the network analysis and direct comparisons for medium-term pain indicated that ESWT combined with orthoses may be more effective than other treatments (highest SUCRA value of 80.3).

I
Fraser et al.[25] found in their systematic review that the inclusion of mobilization techniques in treatment yielded greater improvement in function (6 of 7 studies, CI that did not cross zero in 14 of 25 variables, effect size = 0.5–21.5) and algometry (3 of 3 studies, CI that did not cross zero in 9 of 10 variables, effect size = 0.7–3.0) from 4 weeks to 6 months when compared to interventions such as stretching, strengthening, or modalities. It was recommended that clinicians consider use of both joint and soft tissue mobilization techniques in conjunction with stretching and strengthening when treating patients with plantar fasciitis.

I
In subjects with chronic (> 6 months) plantar fasciitis Costantino et al,[17] investigated the efficacy of cryoultrasound, where cryotherapy and US at 2.4watts/cm^2 were delivered from the same probe (n = 42; mean age 54.7 ± 9.9 years; 24 males, 18 females) to cryotherapy from the probe alone (n = 42; mean

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age 54.73 ± 9.9 years; 23 males, 16 females). Subjects received 10 daily treatments of 20 minutes in duration. Those that received the cryoultrasound had a greater change pain VAS scores with the MD in change in pain between groups at 3 months (3.00 95% CI: 2.29, 3.70) 12 months (4.35 95% CI: 3.75, 4.95) and 18 months (4.82 95% CI: 4.11, 5.50).

II

Grim et al. [29]investigated the effectiveness of manual therapy, customized foot orthoses and combined treatments in sixty-three patients (48.4 ± 9.8 years; 19 males, 44 females) with plantar fasciitis. The interventions all reduced pain and function, with the greatest benefits shown by isolated manual therapy. However, conclusions about the MT group were limited as the groups were not equivalent at the start of the trial.

II

In a RCT [28]with 64 patients, 36 patients (12 males, 24 females) received ultrasound guided 2.5 ml autologous platelet rich plasma (PRP) injection and 28 participants (11 males, 17 females) received phonophoresis and kinesiotaping on alternate days. 54 participants (33 in PRP intervention group and 21 in kinesiotape group) were analyzed. Findings suggest early benefit (2 weeks) from use of phonophoresis with kinesiotaping on alternate days. However, when followed beyond two weeks (12 and 24 weeks), the benefit of PRP injections was greater than the other group, while both groups improved.

Evidence Synthesis

The evidence base for plantar fasciitis interventions are beginning to allow comparisons for combined treatments. The addition of electrical DN [9] or ESWT [22] to manual therapy, exercise, and US seems to result in small to moderate gains for short and medium term pain and function. Manual therapy [25, 29] may be supplemented with the addition of stretching, strengthening, and modalities. However, there was not enough evidence to support a specific recommendation in this area. There was one study that demonstrated benefits combined US delivered daily at 2.4 watts/cm^2 with cryotherapy in the same probe in those with chronic symptoms. The theoretical basis for the benefit of cryoultrasound treatment was that it allows for the potential positive mechanical effects of higher intensity US without the associated thermal effects.

Gaps in Knowledge

While evidence is starting to include and support combined interventions controlled studies are needed to identify what particular combinations are needed. Additional studies are needed to verify and further define the population where the addition of cryotherapy to US at higher intensities produces benefit. In cases where the cryoultrasound is not received daily also needs to be studied. The effect of cryoultrasound on functional outcome also needs to be assessed.

Interventions - Other

This CPG considered ESWT, CSI, and PRP to all be outside the scope of physical therapy practice, despite ESWT being used by physical therapists in certain areas of the world. It should be noted that unlike CSI and PRP, ESWT is a non -invasive treatment that attempts to use direct mechanical forces to promote tissue healing. A meta-analysis found that ESWT was effective in the medium and long-term in

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decreasing pain when compared to control interventions. [30] Three SRs have investigated the effectiveness of CSI compared to other treatments on those with plantar heel pain with some conflicting conclusions.[19],[13],[54] A more recent comprehensive network meta-analysis found that while there is some evidence that CSIs alone or in combination with exercise and ESWT may be effective in improving short-, medium-, and long-term pain or function, the estimates of effect varied widely across trials.[4, 9] There is also some evidence to suggest that PRP can be effective in short-term pain reduction compared to control interventions. [30] When looking at medium term outcomes, ESWT was found to be effective in decreasing pain when compared to CSI. However, no difference was found between these three treatments in short- and long-term in long-term pain control.[30] A Cochrane review noted that the evidence support for CSI was of low quality and although serious adverse events were rare, these were under-reported and a higher risk cannot be ruled out. [19] Potential adverse effects after CSI included post injection steroid-induced increase in pain, fat pad atrophy, nerve injury and rupture of the plantar fascia.

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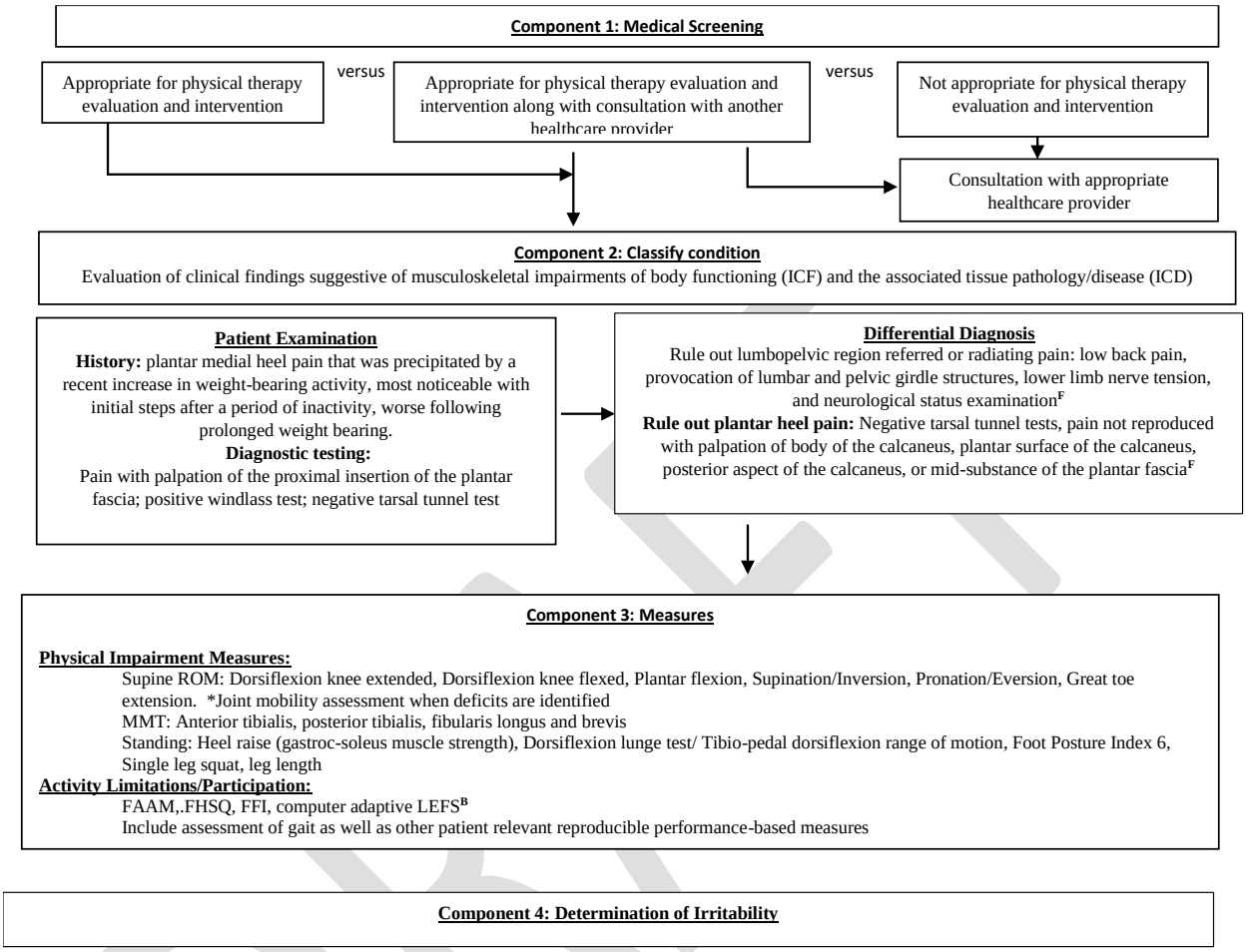
Decision Tree



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Acknowledgements

ACKNOWLEDGEMENTS: The authors would like to acknowledge the contributions of University of Pittsburgh Research Librarian, Rose Turner for her assistance with adapting search design and conducting the literature search. The authors would also like to acknowledge the contribution of Melanie Cen, SDPT, who assisted with title and abstract screening, full text review and data extraction.

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These recommendations and clinical practice guidelines are based on the scientific literature published prior to January 2013.

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