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REVIEW ARTICLE

Consensus statements and guideline for the diagnosis and management of plantar fasciitis in Singapore

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Introduction: Plantar fasciitis (PF) is a common cause of heel pain among the general population. The lack of standard practice guideline in Singapore presents challenges in education and clinical practice for this painful condition. These consensus statements and guideline were developed to streamline and improve the management of PF, covering key aspects such as diagnosis, investigations, risk factors, treatment modalities, monitoring and return to work/play.

Method: A multidisciplinary expert panel consisting of 6 sports physicians, 2 orthopaedic surgeons, 2 podiatrists and 1 physiotherapist from SingHealth Duke-NUS Sport & Exercise Medicine Centre (SDSC) was convened based on their clinical and academic experience with PF. The Grading of Recommendations, Assessment, Development and Evaluations (GRADE) approach was used to evaluate the quality of the evidence and subsequently prepare a set of clinical recommen-dations pertaining to the management of PF. A modified Delphi process was used to reach consensus.

Results: Eighteen consensus statements were developed to cover key components of PF management, from initial diagnosis to treatment modalities and finally, clinical progression. They were subsequently consolidated under a proposed treatment pathway guideline for PF.

Conclusion: The SDSC consensus statements and guideline provide concise recommendations for the management of PF in Singapore.

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Keywords: extracorporeal shockwave, plantar fasciitis, plantar pain, stretching, ultrasonography

CLINICAL IMPACT

What is New

- This guideline provides recommendations on the management of plantar fasciitis (PF) in Singapore.

Clinical Implications

- PF can be diagnosed through history and physical examinations and bedside ultrasonography (US).
- Differentiating other causes of plantar heel pain should prompt further investigation with imaging.
- Standard treatment includes patient and footwear education, activity modification and stretching.
- Extracorporeal shockwave or platelet-rich plasma therapy may be considered for recalcitrant PF before corticosteroid injection or surgery.
- Return to work/play can be guided clinically and through interval US assessment if available.

INTRODUCTION

Plantar fasciitis (PF) is a degenerative disorder of the plantar aponeurosis at the insertion of the plantar fascia into the calcaneus, most commonly at the medial tubercle of the calcaneus.[1,2] Plantar fascia, or plantar aponeurosis, supports the medial longitudinal arch of the weight-bearing foot. With excessive mechanical loading of the plantar fascia, PF develops due to cumulative microtrauma at the calcaneal-fascial interface.[2] Patients classically present with plantar heel pain, worse on the first steps in the morning or after a prolonged period of inactivity. PF is typically unilateral but as many as 30% of patients present bilaterally.[3]

The term "fasciitis" describes acute inflammation in and around the plantar fascia. However, histologic findings revealed a non-inflammatory degenerative pathologic process, better defined by the term "fasciosis".[4] Fasciopathy has been used to encompass both fasciitis (short-term inflammation) and fasciosis (long-term degradation),

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but for the purpose of simplifying the terminology in this paper, the term "fasciitis" will be used.[5]

Approximately 10% of the general population is expected to develop PF over a lifetime.[6] This amounted to a million annual patient visits in the United States during 1995–2000, of which 60% were treated by primary care physicians.[1] PF is common among runners and increasingly prevalent among sedentary individuals.[7,8] In Singapore, there are ongoing efforts to elucidate the local prevalence of PF.

PF is a self-limited condition, but it can take months to years to resolve. This poses a challenge to healthcare providers including primary care physicians and allied health professionals. The role of a clinician in the management of PF is to make an accurate diagnosis and support the treatment pathway as the condition runs its course. Early recognition and treatment of PF is expected to shorten the disease course and increase the likelihood of success with conservative therapies.

Clinical practice guidelines have been widely used to improve the quality of healthcare through evidence-based best practice.[9] Local guidelines for PF management are sparse and hence, it is timely to review current evidence and provide revised recommendations. This study aims to provide evidence-based clinical practice guidelines and develop a clinical pathway algorithm to support clinical decision-making for outpatient PF management in Singapore. The consensus was developed around 5 clinical domains: diagnosis and investigation; risk factors, treatment modalities, monitoring and return to work/play.

METHOD

Panel selection

The formation of the consensus workgroup was initiated by the SingHealth Duke-NUS Sport and Exercise Medicine Centre. Clinicians and allied health professionals from the local public hospitals were recruited for their experience in managing PF. Eleven out of the 14 invited experts agreed to participate. The 11-member panel comprised 6 sports physicians, 2 orthopaedic surgeons, 2 podiatrists and 1 physiotherapist.

Literature review

A core group of 2 experts from the panel considered key clinical questions for PF management (Table 1) and drafted 18 statements based on local practice recommendations, American practice guidelines and topic reviews.[5, 10-13] Further literature review was conducted in PubMed/MEDLINE and ScienceDirect databases up to December 2020 and the statements were revised accordingly. Examples of search terms used were "plantar fasciitis", "plantar fasciosis", "plantar fasciopathy" and "plantar heel pain". The Grading of Recommendations, Assessment, Development and Evaluations (GRADE) framework was used to evaluate the quality of the evidence and assess the strength of the 18 recommendations.[14]

Table 1. Clinical questions.

A) Diagnosis and investigations
• How is PF diagnosed?
• What differential diagnoses of plantar heel pain should be considered?
• What is the utility of radiographic imaging, US and magnetic resonance imaging for the diagnosis of PF?
B) Risk factors
• What are the risk factors for PF?
• How are these risk factors classified?
C) Treatment modalities
• How should PF be managed appropriately?
○ Role of counselling and activity modification
○ Role of stretching and strengthening
○ Role of adequate footwear
○ Role of antipronation taping
○ Role of orthosis
○ Role of night splint
○ Role of oral analgesia
• When should bedside procedures, such as injectables and shockwave therapy, be offered?
• When should surgery be offered?
D) Monitoring of condition
• What are the parameters to assess at follow-up visits?
• What are the considerations if a patient had undergone bedside procedures as treatment?
• Is there a utility for US to monitor response to treatment?
E) Return to work/play
• When can a patient return to lower limb impact activities or sports?
• What are the considerations if a patient uses an orthosis or had undergone bedside procedures?

PF: plantar fasciitis; US: ultrasonography

Consensus process

The consensus process was conducted via a modified Delphi method across 2 online meetings held between February 2021 and March 2021 (COVID-19 pandemic lockdown period). This method describes an iterative process that employs

a systematic progression of repeated rounds of voting to achieve expert group consensus in a given subject with poor empirical evidence and divergence among healthcare professionals.[15-17] In the statements, the use of the word "should" suggested an essential requirement, whereas "can" suggested a desirable requirement. Members of the expert panel were asked to provide agreement (agree, disagree or abstain) to each statement. All responses were kept anonymous. Consensus for each statement was predefined as ≥80% agreement. Any statement that failed the consensus criteria during the first meeting was revised and re-polled at the next meeting. Statements that were not discussed at the first meeting due to time constraints were also revisited at the second meeting.

RESULTS

Out of 18 draft statements proposed, 15 statements were polled in the first meeting with 14 statements achieving consensus. The remaining 3 statements and a revised statement from the first meeting reached consensus in a second meeting held a month later. None of the panel participants abstained from voting. The final 18 statements are summarised in Table 2, each accompanied by its quality of the evidence, strength of recommendation and proportion of the voting agreement. Majority of the 18 consensus statements achieved unanimous acceptance, with statements 4, 7, 12 and 14 achieving 91% agreement.

Consensus statements

The 18 consensus statements pertain to the diagnosis and management of PF, including investigations, assessment of risk factors, treatment modalities, monitoring and return to work/play. These statements are consolidated in a proposed PF treatment pathway algorithm (Fig. 1).

Diagnosis of plantar fasciitis

Statement 1: Plantar fasciitis is diagnosed via history and physical examinations.

Quality of evidence: Grade A

Strength of recommendation: Strong

PF is diagnosed based on clinical assessment.[10,11] Patients usually present with plantar heel pain, particularly worse with the first steps in the morning or after extended periods of inactivity.[3] Symptomatic relief may be achieved with some degree of mobilisation or by off-loading affected foot. However, walking can still be painful as symptoms are aggravated by prolonged weight bearing and expectantly worse towards the end of the day.[10]

Table 2. Summary of consensus statements.

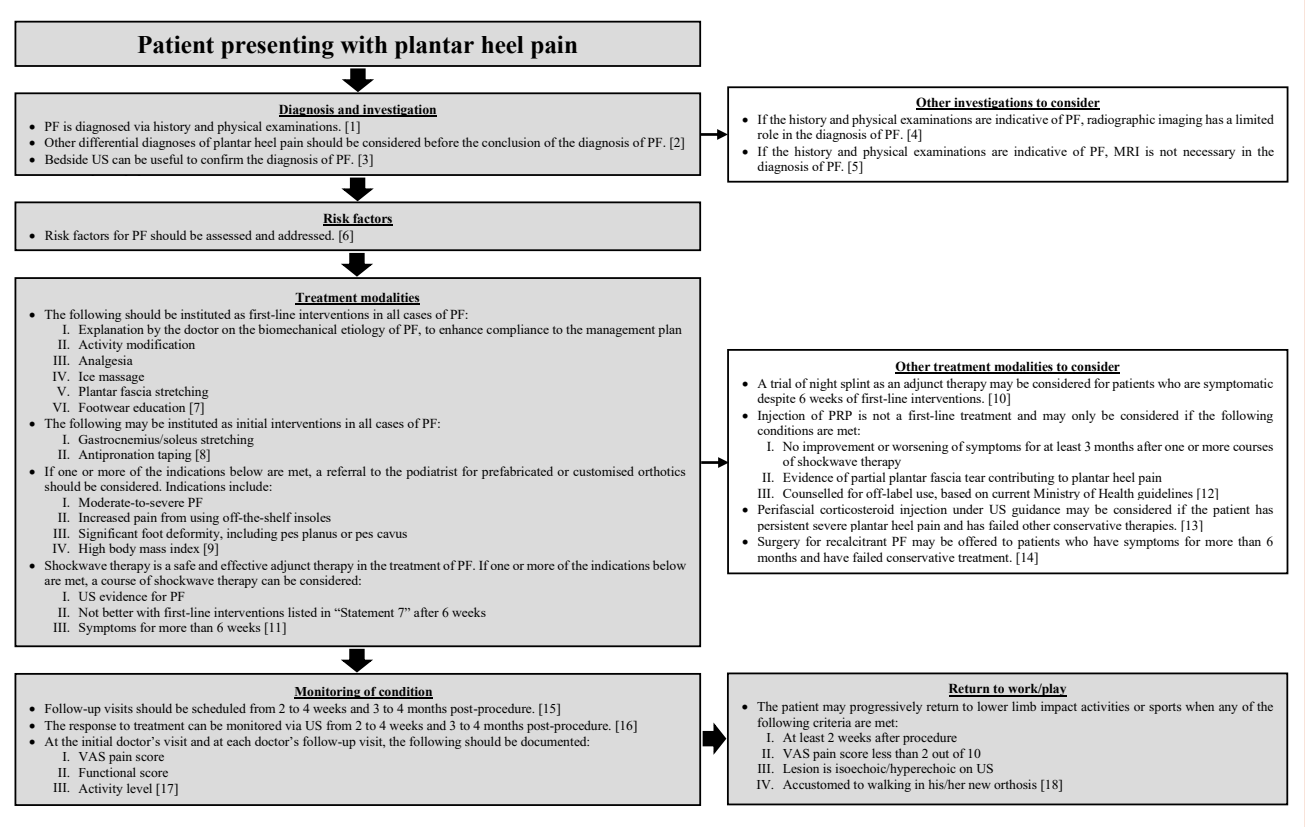
Consensus statements	GRADE	Strength of recommendation	Consensus
A) Diagnosis and investigations			
1. PF is diagnosed via history and physical examinations.	A	Strong	100%
2. Other differential diagnoses of plantar heel pain should be considered before the conclusion of the diagnosis of PF.	A	Strong	100%
3. Bedside US can be useful to confirm the diagnosis of PF.	A	Strong	100%
4. If the history and physical examinations are indicative of PF, radiographic imaging has a limited role in the diagnosis of PF.	B	Strong	91%
5. If the history and physical examinations are indicative of PF, MRI is not necessary in the diagnosis of PF.	B	Strong	100%
B) Risk factors			
6. Risk factors for PF should be assessed and addressed.	A	Strong	100%
C) Treatment modalities			
7. The following should be instituted as first-line interventions in all cases of PF: I. Explanation by the doctor on the biomechanical etiology of PF, to enhance compliance to the management plan II. Activity modification III. Analgesia IV. Ice massage V. Plantar fascia stretching VI. Footwear education	A	Strong	91%

Table 2. Summary of consensus statements. (Cont'd)

Consensus statements	GRADE	Strength of recommendation	Consensus
C) Treatment modalities			
8. The following may be instituted as initial interventions in all cases of PF: I. Gastrocnemius/soleus stretching II. antipronation taping	A	Strong	100%
9. If one or more of the indications below are met, a referral to the podiatrist for prefabricated or customised orthotics should be considered. Indications include: I. Moderate to severe PF II. Increased pain from using off-the-shelf insoles III. Significant foot deformity, including pes planus or pes cavus IV. High body mass index	A	Strong	100%
10. A trial of night splint as an adjunct therapy may be considered for patients who are symptomatic despite 6 weeks of first-line interventions.	B	Weak	100%
11. Shockwave therapy is a safe and effective adjunct therapy in the treatment of PF. If one or more of the indications below are met, a course of shockwave therapy can be considered: I. US evidence for PF II. Not better with first-line interventions listed in "Statement 7" after 6 weeks III. Symptoms for more than 6 weeks	A	Strong	100%
12. Injection of PRP is not a first-line treatment and may only be considered if the following conditions are met: I. No improvement or worsening of symptoms for at least 3 months after one or more courses of shockwave therapy II. Evidence of partial plantar fascia tear contributing to plantar heel pain III. Counselled for off-label use, based on current Ministry of Health guidelines	B	Strong	91%
13. Perifascial corticosteroid injection under US guidance may be considered if the patient has persistent severe plantar heel pain and has failed other conservative therapies.	B	Weak	100%
14. Surgery for recalcitrant PF may be offered to patients who have symptoms for more than 6 months and have failed conservative treatment.	C	Weak	91%
D) Monitoring of condition			
15. Follow-up visits should be scheduled from 2 to 4 weeks and 3 to 4 months post-procedure.	D	NA	100%
16. The response to treatment can be monitored via US from 2 to 4 weeks and 3 to 4 months post-procedure.	D	NA	100%
17. At the initial doctor's visit and at each doctor's follow-up visit, the following should be documented: I. VAS pain score II. Functional score III. Activity level	B	Weak	100%
E) Return to work/play			
18. The patient may progressively return to lower limb impact activities or sports when any of the following criteria are met: I. At least 2 weeks after procedure II. VAS pain score less than 2 out of 10 III. Lesion is isoechoic/hyperechoic on US IV. Accustomed to walking in his/her new orthosis	D	NA	100%

GRADE: Grading of Recommendations, Assessment, Development and Evaluations; MRI: magnetic resonance imaging; PF: plantar fasciitis; PRP: platelet-rich plasma; US: ultrasonography; VAS: visual analogue scale.

Fig. 1. Proposed plantar fasciitis treatment pathway.



MRI: magnetic resonance imaging; PF: plantar fasciitis; PRP: platelet-rich plasma; US: ultrasonography; VAS: visual analogue scale
Numbers enclosed within square brackets indicate the consensus statement number.

Tenderness over the medial calcaneal tubercle and discomfort with passive or active dorsiflexion of the hallux are characteristic physical findings.[13] Patients also tend to have either tight Achilles tendon or gastrocnemius, which limits ankle dorsiflexion and reduces the medial longitudinal arch angle. Associated deformities such as pes planus, pes cavus, foot overpronation, leg-length discrepancy, excessive lateral tibial torsion and excessive femoral anteversion may be present.

Statement 2: Other differential diagnoses of plantar heel pain should be considered before the conclusion of the diagnosis of plantar fasciitis.

Quality of evidence: Grade A

Strength of recommendation: Strong

There are multiple causes for plantar heel pain.[18] If the clinical assessment is atypical for PF, differential diagnoses for heel pain ought to be considered. These conditions may include soft tissue, bone, neurological and inflammatory disorders. For instance, localised tenderness over the posterior calcaneus and a positive calcaneal squeeze test would suggest a calcaneal bone stress injury. A positive Tinel's test over the tarsal tunnel accompanied by paraesthesia would suggest a neurological entrapment or compression etiology such as tarsal tunnel syndrome, medial calcaneal neuropathy or Baxter's neuropathy. Radicular pain and numbness from the lower back to the heel should prompt consideration of S1 radiculopathy related to lumbar spine disorders. Finally, systemic involvement would suggest inflammatory disorders such as reactive arthritis and spondyloarthritis.

Statement 3: Bedside ultrasonography can be useful to confirm the diagnosis of plantar fasciitis.

Quality of evidence: Grade A

Strength of recommendation: Strong

Although bedside ultrasonography US is not required for initial PF diagnosis and management, it can assist clinicians with visualising the foot anatomy in real time and confirming the diagnosis of PF. For the initial US evaluation, both quantitative (thickness) and qualitative (calcifications, echogenicity, tears and vascularity) characteristics of the plantar fascia should be documented. Side-to-side comparison with the asymptomatic heel is also recommended to account for individuals with a thicker baseline plantar fascia.

A normal plantar fascia has a uniform fibrillar echogenic structure that does not exceed 4 mm in thickness at the site of calcaneal insertion.[19] This is corroborated by unpublished local data reporting mean plantar fascia thickness of 3.2 mm among asymptomatic Asian population. Diagnosis of PF is supported by the sonographic findings of fascia thickening >4 mm, reduced echogenicity and/or perifascial effusion.[19-21] The meta-analysis of 11 randomised controlled trials (RCTs) involving 813 individuals revealed that abnormal plantar fascia thickness in PF was on average 2.16 mm thicker than controls (95% confidence interval 1.60–2.71 mm).[22] Hypervascularity of the plantar fascia and adjacent soft tissue can be further demonstrated with power Doppler in acute PF.[23]

Assessment of PF via US is comparable to magnetic resonance imaging (MRI) with regard to accuracy and reliability,[21] demonstrating 81% sensitivity and 86% specificity in a cohort study of 154 patients.[19] Although MRI is a gold standard for diagnosing PF, US is arguably superior since it is cheaper, portable, readily accessible and easy to administer with few contraindications. Combined with its ability to capture real-time snapshots and the dynamic relations of the plantar fascia, US remains a cost-effective tool to diagnose and monitor PF.[21]

Statement 4: If the history and physical examinations are indicative of plantar fasciitis, radiographic imaging has a limited role in the diagnosis of plantar fasciitis.

Quality of evidence: Grade B

Strength of recommendation: Strong

Plain film radiographic imaging is helpful in ruling out other causes of heel pain and should be performed if there is any indication of trauma, pain out of proportion or recalcitrant heel pain not responding to standard treatment. The role of radiography is however limited if the history and physical examinations are indicative of PF.[10,12] A retrospective study found that out of the 81% of a cohort of 215 heels diagnosed with PF, only 2% was found to have radiographic abnormalities which prompted further evaluation but did not change the clinical course.[24]

Common radiographic findings associated with PF include plantar calcaneal spurs, plantar calcifications, cortical irregularities at the plantar fascia origin, abnormal fat pad and plantar fascia thickening >4 mm within 5 mm of its calcaneal attachment.[25] Calcaneal spur formation has a controversial causal association with PF since it can be found in affected and unaffected individuals.[25,26] It is postulated that calcaneal spur development is an adaptive response to repetitive vertical heel compression rather than that of longitudinal traction at the calcaneal-fascial interface.[27] The key radiographic features differentiating PF from controls were changes in soft tissues instead. In an RCT involving 30 heels (24 individuals), the non-weight bearing lateral ankle radiographic findings of abnormal fat pad and thickened plantar fascia achieved 85% sensitivity and 95% specificity for PF.[25] If confirmation of PF is necessary under doubtful clinical assessment, a non-weight bearing lateral ankle radiograph may be considered as the initial radiographic evaluation.[11,25]

Statement 5: If the history and physical examinations are indicative of plantar fasciitis, magnetic resonance imaging is not necessary in the diagnosis of plantar fasciitis.

Quality of evidence: Grade B

Strength of recommendation: Strong

MRI is an important noninvasive diagnostic imaging modality with multiplanar imaging capability and contrast resolution for evaluating a wide range of foot disorders. It can be considered for patients with protracted heel pain not responding to standard treatment or when the clinical assessment is suggestive of another etiology. MRI is useful for demonstrating key pathological changes of the plantar fascia in PF, in addition to those that can already be detected with US or radiographs. However, certain associated structural changes may not always be consistent with symptoms and are not required for the diagnosis of PF. Findings such as calcaneal spurs, soft-tissue edema superficial to the plantar fascia and increased T1-weighted signal changes of the plantar fascia have been observed in asymptomatic individuals, likely reflecting physiologic changes or asymptomatic degeneration.[2] Such information conferred by MRI incurs additional cost without value-adding to the management of patients whose symptoms and signs are already suggestive of PF. Although MRI is capable of delineating structural alterations of the plantar fascia, clinical correlation remains crucial to avoid unnecessary investigation.[10]

Assessment of risk factors

Statement 6: Risk factors for plantar fasciitis should be assessed and addressed.

Quality of evidence: Grade A

Strength of recommendation: Strong

Development of PF is usually multifactorial, and it is not unusual to have more than one risk factor in the same patient. These risk factors can be broadly categorised as intrinsic or extrinsic (Table 3). They contribute to biomechanical abnormalities during gait phases, which in turn

cause mechanical overload and excessive tensile strain within the plantar fascia.

Table 3. Risk factors for PF.

Categories	Factors
A) Intrinsic	
Anatomical	• Excessive femoral anteversion
	• Leg-length discrepancy
	• Obesity
	• Pes cavus (high-arched feet)
	• Pes planus (flat feet)
Biomechanical	• Achilles tendon tightness
	• Hamstring tightness
	• Limited ankle dorsiflexion
	• Overpronation
	• Triceps surae tightness
B) Extrinsic	
Footwear	• Poor arch or heel support
	• Worn out footwear
Occupation	• Carrying heavy loads
	• Prolonged standing
Training	• Changes in running form
	• Inappropriate training load

Intrinsic risk factors are related to the individual characteristics of the person and can be divided into anatomical and biomechanical factors.[29] Anatomic risk factors include obesity, pes planus, pes cavus, excessive femoral anteversion and leg-length discrepancy. Pes planus subjects the plantar fascia to excessive stress during foot strike while pes cavus causes excessive strain on the heel because the foot fails to evert or absorb shock effectively.[30,31] Biomechanical risk factors include overpronation, limited ankle dorsiflexion and tightness of the hamstrings, triceps surae and Achilles tendon.[32,33]

Extrinsic risk factors refer to factors related to the footwear, occupation and training.[29] For example, worn out shoes with poor arch or heel support and training errors, such as inappropriate running form or volume can contribute to PF development. Occupations requiring prolonged standing or heavy lifting can also lead to mechanical overloading of the plantar fascia.[32]

Management of PF

Treatment for PF is varied, and most patients respond well to nonsurgical interventions. The following recommendations provide guidance for clinicians to tailor treatment according to the chronicity and severity of symptoms, and requirements of the patient's lifestyle.

Statement 7: The following should be instituted as first-line interventions in all cases of plantar fasciitis:

I. Explanation by the doctor on the biomechanical etiology of plantar fasciitis, to enhance compliance to the management plan
II. Activity modification
III. Analgesia
IV. Ice massage
V. Plantar fascia stretching
VI. Footwear education

Quality of evidence: Grade A

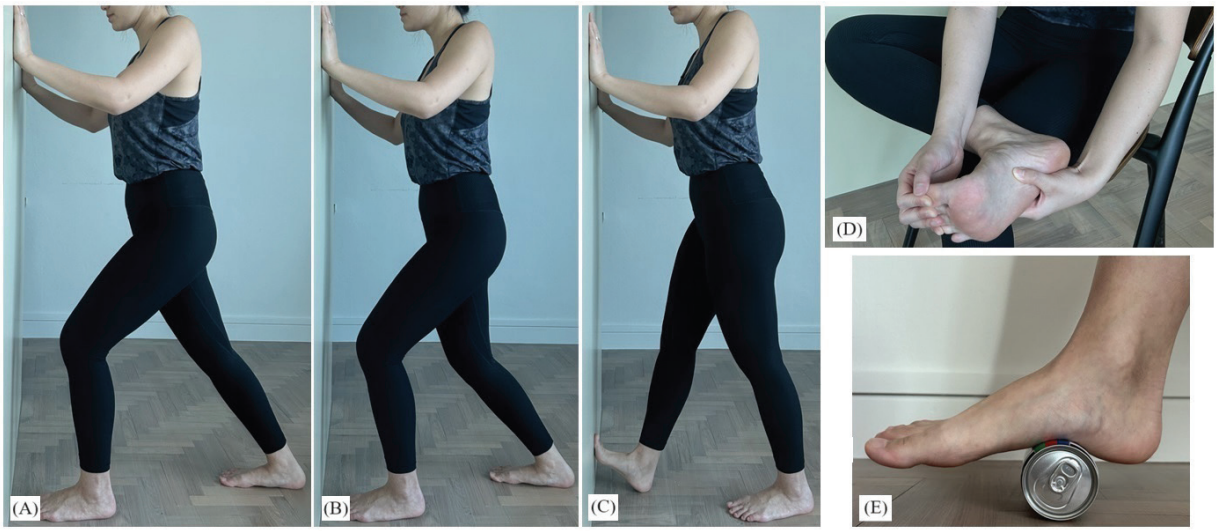
Strength of recommendation: Strong

Patient education is arguably the most important factor in a patient-centric management plan. Effective communication conveying the etiology of PF and its relations to the patient's biomechanical risk factors helps increase treatment compliance and adherence.[34] The volume and intensity of patient's physical activity should be explored and modified to minimise loading stress on the plantar fascia. For runners, it can be worthwhile to evaluate their running biomechanics as certain foot strike pattern modification may predispose them to increased risk of PF.[35] Analgesia, including paracetamol and non-steroidal anti-inflammatory drugs, can be offered for short-term pain relief.[11] Ice massage is also useful for pain and inflammation reduction in PF (Fig. 2).[11]

Plantar fascia stretching, as a form of manual therapy intervention, is an effective treatment for PF (Fig. 2). A randomised parallel study involving 102 participants with acute PF showed that improvement in pain and function with plantar fascia stretching as the initial treatment was superior to extracorporeal shockwave therapy (ESWT) after 2 and 4 months.[36] A similar study of 63 patients found that isolated manual therapy including plantar fascia stretching was more effective for pain control and function over 3 months than orthoses or combined therapy.[37] Overall, a systematic study of 7 RCTs demonstrated that manual therapy improves pain and function more effectively than comparative interventions.[38]

Appropriate footwear with good arch support and cushioned heels prevents exacerbation of

Fig. 2. (A) Calf stretch with knee extended. (B) Calf stretch with knee flexed. (C) Standing plantar fascia stretch. (D) Sitting plantar fascia stretch with assessment of plantar fascia tautness. (E) Cold massage with a frozen can.



PF by ensuring adequate support of the medial longitudinal arch.[10,39] However, plantar symptoms may still recur as the soles of shoes degrade over time. Hence, shoe fitting and construction should be routinely examined by clinicians for its foot support.[39]

Statement 8: The following may be instituted as initial interventions in all cases of plantar fasciitis:

I. Gastrocnemius/soleus and Achilles tendon stretching

II. Antipronation taping

Quality of evidence: Grade A

Strength of recommendation: Strong

Besides plantar fascia stretching, calf or Achilles tendon stretching may play an important role in PF treatment (Fig. 2).[40,41] Significant pain reduction was demonstrated in a 50-patient RCT after just 4 weeks with Achilles tendon stretches or simultaneous Achilles and plantar fascia stretches.[41] Furthermore, inclusion of myofascial trigger point massage with these stretches resulted in greater short-term pain relief in a 60-patient RCT.[40] Hence, we advocate for clinicians to educate patients on the proper stretching of the plantar fascia, Achilles tendon and calf muscles, with the consideration for a referral to outpatient supervised training.

Antipronation taping helps support the medial longitudinal arch and reduce mechanical stress on the plantar fascia. When compared against no taping or sham taping in a systematic review of 7 RCTs, taping showed significant pain reduction with improvement of weight distribution and plantar fascial thickness.[42] Another systematic review involving 4 RCTs and 1 controlled trial supported short-term pain relief with taping as early as the first week, regardless of its implementation with or without stretching.[43]

Statement 9: If one or more of the indications below are met, a referral to the podiatrist for prefabricated or customised orthoses should be considered. Indications include:

I. Moderate to severe plantar fasciitis

II. Increased pain from using off-the-shelf insoles

III. Significant foot deformity, including pes planus or pes cavus

IV. High body mass index

Quality of evidence: Grade A

Strength of recommendation: Strong

Foot orthoses are removable in-shoe devices designed to correct biomechanical foot issues and deformities. Heel inserts and insoles are commonly prescribed by podiatrists for PF, and both prefabricated and customised options are safe and effective for pain relief.[44,45] The mechanism for pain relief is attributed to adequate medial arch support and plantar pressure redistribution during prolonged weight bearing.[44] Meta-analysis of 7 RCTs of 693 patients found moderate-quality evidence supporting medium-term pain relief with orthoses for 7–12 weeks,

with no difference between prefabricated and customised orthoses.[45] Foot deformities such as pes planus and pes cavus, which subject individuals to increased plantar fascia strain, can be corrected with orthoses. Obese individuals will also expectantly benefit since they experience excessive and repetitive compressive forces under their heel when weight bearing.[46] Nonetheless, it is crucial to tailor the eventual choice of orthoses according to the patient's preference and associated musculoskeletal issues.

Statement 10: A trial of night splint as an adjunct therapy may be considered for patients who are symptomatic despite 6 weeks of first-line interventions.

Quality of evidence: Grade B

Strength of recommendation: Weak

Night splint addresses early morning heel pain by reducing nocturnal contracture of the gastrocnemius-soleus complex or damaged plantar fascia.[47] Effectiveness of night splint for PF remains controversial. Nevertheless, several studies have shown positive outcomes for night splint when included with standard conservative treatment.[42,47,48] In a controlled trial of 28 patients, application of night splints with foot orthoses was more effective than the latter alone,[48] indicating a complementary relationship in reducing nocturnal and diurnal plantar fascia stress. Furthermore, a randomised crossover study of 37 patients with recalcitrant PF demonstrated long-term pain improvement over 6 months with just a 4-week splinting protocol.[49] It is worth noting that compliance may pose a challenge as night splint can be uncomfortable.[49] Nonetheless, a trial of night splint is an acceptable adjunct if prior standard treatment has failed.

Statement 11: Shockwave therapy is a safe and effective adjunct therapy in the treatment of plantar fasciitis. If one or more of the indications below are met, a course of shockwave therapy can be considered:

I. Ultrasonography evidence for plantar fasciitis

II. Not better with first-line interventions listed in "Statement 7" after 6 weeks

III. Symptoms for more than 6 weeks

Quality of evidence: Grade A

Strength of recommendation: Strong

ESWT is an effective and safe treatment for chronic PF.[50,51] It is typically applied to the most tender point over the medial calcaneal tubercle. Its therapeutic mechanism is multimodal, providing analgesic effect via neural desensitisation and physiological healing via neovascularisation and collagen synthesis.[50] Meta-analysis of 9 RCTs found that ESWT improved visual analogue scale (VAS) pain score in recalcitrant PF by 60%, with little to no functional limitation for 3 months.[51] In acute PF, a course of 3 weekly sessions of ESWT in a randomised parallel study of 102 participants was however found to be inferior to an 8-week course of plantar fascia stretching as first-line treatment.[36] Although there are no serious adverse side effects, ESWT can be associated with higher healthcare cost and increased pain or swelling during and after intervention.[50] Therefore, all patients ought to have undergone a trial of standard treatment before considering ESWT.

Statement 12: Injection of platelet-rich plasma is not a first-line treatment, and it may only be considered if the following conditions are met:

I. No improvement or worsening of symptoms for at least 3 months after one or more courses of shockwave therapy

II. Evidence of partial plantar fascia tear contributing to plantar heel pain

III. Counselled for off-label use, based on current Ministry of Health guidelines

Quality of evidence: Grade B

Strength of recommendation: Strong

Platelet-rich plasma (PRP) is an autologous product known for its healing properties. It promotes tissue regeneration at the target connective tissue site (tendon, ligament or muscle) via release of autologous growth factors from α-granules found within platelets.[52] Evidence for PRP as first-line treatment for PF is limited. A local randomised parallel study of 54 patients with chronic PF showed that PRP, as an adjunct to standard treatment, provided better pain reduction and function for PF than standard treatment alone.[53] This outcome was echoed for patients managed by ESWT as an adjunct to standard treatment, but there was ultimately no difference between the PRP and ESWT treatment groups.[53] When compared against corticosteroid injection therapy, PRP demonstrated superior long-term pain reduction from 3 to 12 months in a meta-analysis involving 15 studies.[54] Taking heed of current national body recommendations, PRP should be considered cautiously and offered only after unsuccessful trials of ESWT or when a partial plantar fascia tear is evident.

Statement 13: Perifascial corticosteroid injection under ultrasonography guidance may be considered if the patient has persistent severe plantar heel pain and has failed other conservative therapies.

Quality of evidence: Grade B

Strength of recommendation: Weak

Perifascial corticosteroid injection to the plantar fascia under ultrasound guidance mediates symptom relief through its anti-inflammatory effects. It can provide short-term pain relief up to only 4 weeks.[55,56] Although relatively cheap and safe to administer, there is limited evidence supporting the effectiveness of corticosteroid injection against first-line interventions.[55,57] When compared to ESWT in a 49-patient RCT, corticosteroid injection was inferior at improving long-term pain and function beyond 4 weeks.[58] Should corticosteroid injection be offered, potential adverse effects such as plantar fascia rupture and fat pad atrophy ought to be counselled. If performed, corticosteroid injection is recommended to be limited to a single course and to individuals not engaged in any explosive, weight-bearing lower limb activities.

Statement 14: Surgery for recalcitrant plantar fasciitis may be offered to patients who have symptoms for more than 6 months and have failed conservative treatment.

Quality of evidence: Grade C

Strength of recommendation: Weak

Chronic PF with persistent severe symptoms despite appropriate standard treatment for at least 6 months may be considered for surgical intervention.[10,12] Plantar fasciotomy and gastrocnemius release are two commonly performed procedures aimed at reducing plantar fascial tension in PF.[12] The latter is favoured over fasciotomy as it is associated with lower morbidity and better patient satisfaction in a retrospective cohort study.[59] Newer surgical techniques such as cryosurgery and ultrasonic debridement have been introduced, but their effectiveness remains to be seen.[12]

Monitoring of PF

Statement 15: Follow-up visits should be scheduled between 2 to 4 weeks and 3 to 4 months post-procedure.

Quality of evidence: Grade D

Strength of recommendation: Not applicable

Statement 16: The response to treatment can be monitored via ultrasonography between 2 to 4 weeks and 3 to 4 months post-procedure.

Quality of evidence: Grade D

Strength of recommendation: Not applicable

Statement 17: At the initial doctor's visit and at each doctor's follow-up visit, the following should be documented:

I. VAS pain score

II. Functional score

III. Activity level

Quality of evidence: Grade B

Strength of recommendation: Weak

Guidelines for monitoring PF progression post-procedure are poorly elucidated in literature. Patient-reported outcome measures (PROMs) such as the VAS pain score, Roles and Maudsley scale and American Orthopaedic Foot and Ankle Society ankle-hind foot scale are useful tools to track improvements in pain and function throughout the treatment period. Objective interval US assessment of the plantar fascia thickness is a quick and cost-effective adjunct to PROMs since clinical progression has been shown to correlate with plantar fascia thickness.[60] Indeed, a prospective longitudinal study of 22 patients with recalcitrant PF demonstrated significant gradual reduction of VAS pain score and plantar fascia thickness over 12 months after undergoing ESWT.[61] The expert panel recommends for at least 2 interval reviews at 2 to 4 weeks and 3 to 4 months post-procedure. However, interval US changes are likely more discernible after several months versus short weeks post-procedure. This is also influenced by the experience and skills of the sonographer.

Return to lower limb impact activities or sports

Statement 18: The patient may progressively return to lower limb impact activities or sports when any of the following criteria are met:

I. At least 2 weeks after procedure

II. VAS pain score less than 2 out of 10

III. Lesion is isoechoic/hyperechoic on ultrasonography

IV. Patient is accustomed to walking in his/her new orthosis

Quality of evidence: Grade D

Strength of recommendation: Not applicable

Guidelines on the return to work/play for patients with PF are scant. Patients with prescribed orthoses

are expected to resume lower limb activities once they are accustomed to their in-shoe devices. A progressive return to lower limb activities at least 2 weeks post-procedure is recommended by the expert panel. Interval US assessment post-procedure can expectantly show a recovered plantar fascia evident by an isoechoic or hyperechoic appearance. It is worth noting that the US changes associated with PF may still be present in asymptomatic runners or athletes; as such, clinical history should primarily guide return to work/play. In general, patients experiencing an overall VAS pain score less than 2 out of 10 may attempt a graduated return to work/play.

CONCLUSION

This guide summarised the current evidence and presented recommendations on the outpatient management of patients with PF for healthcare professionals practicing in Singapore. It is acknowledged that management can vary according to the needs of the individual, resource availability and limitations of the institution of practice. Evidence gaps in certain areas of management and monitoring of PF remains, and it is crucial for clinical practice to be continuously refined as new evidence emerges. Although these guidelines do not define a standard of care, they are intended to improve the practice standards for PF management.

Declaration of conflicting interests

The authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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