International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Scholarly Publisher
RS Global Sp. z O.O.
ISNI: 0000 0004 8495 2390

Dolna 17, Warsaw,
Poland 00-773
+48 226 0 227 03
editorial_office@rsglobal.pl

ARTICLE TITLE	RECENT ADVANCES IN THE MANAGEMENT OF PLANTAR FASCIITIS: A SYSTEMATIC REVIEW
DOI	https://doi.org/10.31435/ijitss.3(47).2025.3706
RECEIVED	14 August 2025
ACCEPTED	08 September 2025
PUBLISHED	15 September 2025
LICENSE	The article is licensed under a **Creative Commons Attribution 4.0 International License.**

RECENT ADVANCES IN THE MANAGEMENT OF PLANTAR FASCIITIS: A SYSTEMATIC REVIEW

Kacper Dywan *[KD] (Corresponding Author, Email: kacper.dywan2@gmail.com)*
Railway Hospital named after dr med. Włodzimierza Roeflera, Warsztatowa 1, 05-800 Pruszków, Poland
ORCID ID: 0009-0006-4551-7902

Joanna Kośka *[JK]*
Military Institute of Medicine, Szaserów 128, 04-141 Warsaw, Poland
ORCID ID: 0009-0003-5971-6222

Gabriela Łocik *[GŁ]*
Wolski Hospital named after dr Anna Gostyńska, Marcina Kasprzaka 17, 01-211 Warsaw, Poland
ORCID ID: 0009-0000-8111-279X

Katarzyna Moliszewska *[KM]*
Independent Public Central Clinical Hospital in Warsaw, ul. Banacha 1A, 02-097 Warsaw, Poland
ORCID ID: 0009-0009-5459-4338

Paweł Kukiełka *[PK]*
State Medical Institute of the Ministry of the Interior and Administration in Warsaw, Wołoska 137, 02-507 Warsaw, Poland
ORCID ID: 0009-0007-0303-6999

Julia Mazurek *[JM]*
Independent Public Clinical Hospital named after prof. Witold Orłowski CMKP, ul. Czerniakowska 231, 00-416 Warsaw, Poland
ORCID ID: 0009-0003-7753-7797

Julia Załęcka *[JZ]*
Military Institute of Medicine, Szaserów 128, 04-141 Warsaw, Poland
ORCID ID: 0000-0003-3851-3066

Martyna Musiorska *[MM]*
Central Teaching Hospital of the Medical University of Lodz, Pomorska 251, 92-213 Łódź, Poland
ORCID ID: 0009-0000-9773-5449

Michał Błaszkiewicz *[MB]*
State Medical Institute of the Ministry of the Interior and Administration in Warsaw, Wołoska 137, 02-507 Warsaw, Poland
ORCID ID: 0009-0005-5417-9688

ABSTRACT

Introduction and Purpose: Plantar fasciitis (PF) is one of the most common causes of heel pain in adults, with a lifetime incidence of about 10%. Diagnosis is primarily clinical, based on patient history and physical examination. This study aims to present and compare treatment modalities for PF, including conservative and surgical options.
Brief Description of the State of Knowledge: The plantar fascia is a dense connective tissue crucial for supporting the medial longitudinal arch and enabling efficient gait. PF most often affects individuals aged 45–65 and is frequently associated with elevated body mass index. A characteristic symptom is sharp heel pain upon rising in the morning, which improves with walking. Physical examination may include the Silfverskiöld test to assess gastrocnemius contracture. Imaging, such as radiography, ultrasonography, or MRI, can support diagnosis. Although PF often recurs, 85–90% of patients respond to conservative treatment. Historically, management relied on night splints, orthoses, NSAIDs, and corticosteroid injections. Current strategies emphasize stretching and strengthening exercises. Surgical treatment is reserved for refractory cases.
Materials and methods: In this article, we utilized scientific literature describing various treatment approaches for patients with PF. Particular attention was given to diagnostic strategies and the appropriate use of imaging modalities. Treatment efficacies were compared, and potential adverse effects were also discussed.
Conclusions: Multiple therapies for PF show similar efficacy. Conservative management should remain first-line, with surgery considered when nonoperative measures fail. Successful outcomes depend on individualized treatment, patient education, and adherence. Collaboration between orthopedic surgeons and physiotherapists plays a key role in optimizing care.

KEYWORDS

Plantar Fasciitis, Heel Pain, Heel Spur, Silfverskiöld Test, Gastrocnemius Muscle Contracture

CITATION

Kacper Dywan, Joanna Kośka, Gabriela Łocik, Katarzyna Moliszewska, Paweł Kukiełka, Julia Mazurek, Julia Załęcka, Martyna Musiorska, Michał Błaszkiewicz. (2025) Recent Advances in the Management of Plantar Fasciitis: A Systematic Review. *International Journal of Innovative Technologies in Social Science*. 3(47). doi: 10.31435/ijitss.3(47).2025.3706

Introduction

Plantar fasciitis (PF), typically a self-resolving disorder, is one of the most frequent etiologies of heel pain in the adult population (Riddle & Schappert, 2004). It is estimated that approximately one in ten individuals will experience PF at some point during their lifetime (Monteagudo et al., 2018). Patients with PF typically present to primary care physicians as their first point of contact for evaluation and management of heel pain (Goff & Crawford, 2011; Riddle & Schappert, 2004). Diagnosis of the PF is usually built on patient's history and physical examination. Over the past 15 years, non-surgical management strategies have shifted from a primary reliance on orthotics and splinting toward the incorporation of stretching exercises as a central component of treatment (Monteagudo et al., 2018). Histopathological evaluations more frequently reveal tissue thickening and degenerative alterations rather than overt inflammatory changes. The term 'fasciitis' may be somewhat misleading, as it implies an inflammatory etiology, which does not accurately reflect the predominant degenerative nature of the condition (Monteagudo et al., 2018).

Anatomy

The plantar fascia is a thick connective tissue structure that plays a crucial role in maintaining the integrity and stability of the foot's arch (Cutts et al., 2012). It delivers a connection between the calcaneal tuberosity, the proximal phalanx of each toe and the metatarsal heads, giving solid mechanical support (Lemont et al., 2003). The plantar fascia functions dynamically throughout the gait cycle, lengthening during the stance phase and accumulating potential energy in the process. Subsequently, the plantar fascia undergoes passive recoil, transforming the stored potential energy into kinetic energy, thereby contributing to forward propulsion (Cutts et al., 2012).

Risk Factors

Although its exact pathogenesis remains unclear (Monteagudo et al., 2018), several risk factors have been identified. PF most commonly affects individuals between the ages of 45 and 65 (Monteagudo et al., 2018; Riddle & Schappert, 2004). An increased range of motion in plantarflexion, as well as increased BMI and body mass has been identified as a potential risk factor for the development of PF (Hamstra-Wright et al., 2021). Biomechanical irregularities of the foot, including a shortened Achilles tendon, high arches (pes cavus), and flat feet (pes planus), have also been linked to the occurrence of PF (Cutts et al., 2012; Gill, 1997).

Additionally, patients with certain spondyloarthropathies may have an increased incidence of PF, especially among younger patients, suggesting a possible inflammatory component (Jung et al., 2024).

Clinical findings

Plantar heel pain constitutes the most common symptom promoting patients to seek medical evaluation. This discomfort is usually most severe upon initial steps in the morning and decreases progressively as ambulation continues (Monteagudo et al., 2018). During sleep, the plantar fascia undergoes mild contraction, and the sudden stretching that occurs upon waking is likely a key factor contributing to the onset of pain (Cutts et al., 2012).

Previous study presented, that approximately 83% of individuals diagnosed with PF exhibit restricted ankle dorsiflexion (Monteagudo et al., 2018; Patel & DiGiovanni, 2011). A limitation is strongly attributed to isolated gastrocnemius tightness (Nakale et al., 2018).

Pain can be increased by prolonged activities such as walking or running (Thomas et al., 2001). The onset of pain symptoms may be associated with a recent increase in the patient's physical activity, for example job transition (Goff & Crawford, 2011). Paresthesia is not considered to be a typical clinical finding (Rompe et al., 2010).

Previous study presented, that approximately 83% of individuals diagnosed with PF exhibit restricted ankle dorsiflexion (Monteagudo et al., 2018; Patel & DiGiovanni, 2011). A limitation is strongly attributed to isolated gastrocnemius tightness (Nakale et al., 2018). Shortening of this muscle elevates tension within the Achilles tendon and contributes to reduced foot dorsiflexion flexibility, thereby amplifying stress on the plantar fascia during walking (Riddle, Pulisic, Pidcoe, & Johnson, 2003).

During clinical examination, patients commonly adopt an equinus foot position during gait, in order to avoid pain on the heel (Rompe et al. 2009). Assessment typically reveals tenderness over the medial calcaneal region, which is exacerbated by passive dorsiflexion, indicating involvement of the plantar fascia (Riddle & Schappert, 2004).

The Silfverskiöld test is used to evaluate isolated gastrocnemius muscle contracture. To perform the test, the patient is positioned in the prone position. Ankle dorsiflexion is first assessed with the knee fully extended, and then re-evaluated with the knee flexed to approximately 90 degrees (Noriega et al., 2022; García-Vidal et al., 2018). The test is considered to be positive, when the maximal ankle dorsiflexion on the flexed knee is greater than when the knee is extended. Such a result is indicative of isolated gastrocnemius tightness (Nakale et al., 2017; Fazal et al., 2017).

Imaging

Although the primary role of the physician is to obtain a patient history and perform a thorough clinical examination, imaging studies may be utilized as a complementary diagnostic tool. The choice of imaging modality depends on the individual needs of the patient and may help guide appropriate treatment strategies.

Conventional radiographs are commonly employed as an initial diagnostic tool, with the presence of a calcaneal spur being a characteristic finding often observed in patients with PF (Goff & Crawford, 2011). Patients diagnosed with PF exhibited a markedly higher prevalence of calcaneal spurs than those in the control cohort (Kumai & Benjamin, 2002). On the other hand spurs are frequently observed in individuals without symptoms, with research indicating a prevalence of 11% in the U.S. population. This supports the notion that such spurs may be incidental rather than causative (Kibler et al., 1998). Moreover, results indicate that bony spur presence and size are not predictive of pain severity or clinical presentation (Monteagudo et al., 2018; Ahmad et al., 2016).

A recent study performer on 141 participants revealed, that plantar fascia thickening was the most frequently observed abnormality in the MRI scan and was present in every case. Nevertheless, research has shown no significant association between the degree of plantar fascia thickening and the intensity of heel pain (Fazal et al., 2017). Additionally, a systematic review demonstrated, that the presence of hyper intensive signal in the MRI scan is 146 times more probable to occur in patients with plantar heel pain compared to a control

group (Drake et al., 2022). MRI can aid in excluding alternative diagnoses and identifying uncommon pathologies in the heel region (Monteagudo et al., 2018).

Ultrasound's effectiveness in detecting and monitoring PF was the subject of analysis in a recent systematic review. One of them examined the application of ultrasound in the context of PF, concluding that it is a precise, dependable, and non-invasive method for measuring plantar fascia thickness, evaluating treatment outcomes, and assisting in the administration of therapeutic interventions (Mohseni-Bandpei et al., 2014). In comparison to MRI, ultrasound provides equivalent diagnostic value, including visualization of fascial thickness and structural abnormalities, while offering advantages in cost, accessibility, and real-time monitoring (Sabir et al., 2005).

Treatment

Numerous therapeutic options have been developed for PF, and the overall approach to management has shifted considerably in recent years. The majority of patients with PF as approximately 85 to 90% on patients respond well to conservative therapy without the need for surgical intervention (Schepsis et al., 1993). Nevertheless recurrent PF consists a typical clinical figure. The issue was addressed in a longitudinal study that evaluated 174 patients over a 5- to 15-year follow up. Findings indicated that the likelihood of persistent PF symptoms was 50.0% at 5 years, gradually decreasing to 45.6% at 10 years and 44.0% at 15 years following symptom onset (Hansen et al., n.d.). Activity modification, including relative rest and avoiding aggravating activities, is a key component in the conservative management of PF, helping to reduce stress on the plantar fascia and alleviate symptoms (Lim et al., 2016). Avoidance of aggravating activities through lifestyle modification constitutes the most straightforward method of managing the condition (Poenaru et al., 2021). Among the recommended adjustments notable may be appropriate footwear selection as a study conducted on amateur runners demonstrated that it can significantly reduce pain symptoms (Cornwall et al., 2017; Poenaru et al., 2021).

Night splints

Night splints, first introduced as a treatment for PF by Wapner and Sharkey in 1991, represent one of the earlier therapeutic approaches used to manage the condition (Beyzadeoglu et al., 2007). This method involves maintaining the ankle in a neutral or dorsiflexed position during sleep (Lee et al., 2012). Night splints may be employed as an adjunct to standard therapy, however, they have not been shown to reduce the risk of symptom recurrence over a two-year follow-up period (Beyzadeoglu et al., 2007). Moreover, some studies have indicated that night splints may cause foot discomfort, which can negatively impact sleep quality (Lee et al., 2012; Young et al., 2001).

Foot orthoses

The use of foot orthoses is based on reducing plantar pressure, which in turn decreases the mechanical load on the plantar fascia, thereby alleviating symptoms of PF (Gerrard et al., 2020). An analysis of 19 randomized clinical trials involving 1,660 patients demonstrated that foot orthoses may be effective in reducing pain in the medium term (7–12 weeks); however, their impact on function was not significant. In the long term (13–52 weeks), there was no evidence of improvement in pain or function (G. Whittaker et al., 2017).

Stretching and strengthening

Effective collaboration between the physician and physiotherapist enables the implementation of both stretching and strengthening exercises as integral components of a non-invasive treatment strategy for PF. This multidisciplinary approach ensures proper exercise prescription, patient education, and adherence, thereby optimizing therapeutic outcomes.

High-load strength training involves performing single-leg heel raises with the toes dorsiflexed over a rolled towel to effectively engage the windlass mechanism. This exercise is typically carried out on a step or stair to allow for a greater range of motion and increased loading of the plantar fascia (Rathleff et al., 2014).

A randomized controlled trial by DiGiovanni et al. demonstrated that a non–weight-bearing plantar fascia-specific stretching protocol, involving dorsiflexion of the toes and ankle with the foot crossed over the opposite knee, performed three times daily, significantly reduced both worst pain and first-step morning pain over an 8-week period compared to standard Achilles tendon stretching (DiGiovanni et al., 2003). In another study, both stretching and strengthening exercises were evaluated for their effectiveness in managing PF. The findings demonstrated that each intervention led to comparable improvements in pain reduction and gait function after the 3 month follow-up. Notably, both the intensity of the worst pain and morning discomfort

significantly decreased in each group, with no substantial differences observed between the two approaches (Thong-On et al., 2019). Both stretching and strengthening exercises require patient adherence and active participation to achieve therapeutic effectiveness. Consistent engagement and proper technique are essential for optimal outcomes in the management of PF (Rathleff et al., 2014).

Extracorporeal Shock Wave Therapy (ESWT)

The physiological impacts of shockwaves have been extensively studied, revealing that various energy forms influence the musculoskeletal system by alleviating pain and promoting tissue repair. Positive outcomes have been demonstrated in treating multiple musculoskeletal conditions, including PF (Bannuru et al., 2014; Gollwitzer et al., 2015; Rompe & Maffulli, 2007; Tenforde et al., 2022). Cited recent meta-analysis demonstrates that ESWT serves as an effective noninvasive therapy for managing PF, resulting in significantly greater pain relief compared to placebo (Tung et al., 2025). Furthermore, a systematic review and meta-analysis suggested that ESWT may reduce plantar fascia thickness, a structural marker of PF, though it did not show a significant advantage over other non-invasive interventions in long-term pain reduction (Simental-Mendía et al., 2024).

Non-steroidal anti-inflammatory drugs (NSAIDs)

In response to acute pain, patients frequently resort to non-steroidal anti-inflammatory drugs (NSAIDs) (Poenaru et al., 2021). While these medications offer short-term pain relief, they have limited long-term efficacy. NSAIDs carry several drawbacks, notably an increased risk of gastrointestinal bleeding, abdominal discomfort (Chi et al., 2018), and potential renal impairment (Hörl, 2010).

Corticosteroid injection

Corticosteroid injection represents an additional option for managing acute pain episodes in individuals with PF. This approach has been in use since the 1950s, making it one of the oldest interventions. A review of ten randomized controlled trials demonstrated that while corticosteroid injections significantly reduce pain, their effects are typically short-term, lasting between 4 and 12 weeks (Ang, 2015). A study conducted on 120 patients revealed that plantar fascia rupture occurred in 3 individuals who received steroid treatment. This adverse effect is suspected to be associated with high BMI, which may increase the risk of fascial rupture (Kim et al., 2010). The other side effect constitutes degeneration of both the plantar fascia and the heel fat pad, potentially resulting in persistent discomfort and chronic pain (Latt et al., 2020).

Platelet – rich plasma (PRP)

Platelet-rich plasma (PRP) is regarded as an autologous blood-derived product that can be externally administered to different tissues, delivering elevated levels of platelet-derived growth factors that facilitate the repair of wounds, bones, and tendons (Mohamed et al., 2012; Sampson et al., 2008). Autologous PRP was initially applied in 1987 by Ferrari et al. during open heart surgery. In subsequent years, its use expanded into orthopedics, where it has been employed as a substance to accelerate tissue healing (Ferrari et al. 1987; Sampson et al., 2008). A meta-analysis demonstrated that platelet-rich plasma (PRP) is more effective than corticosteroid injections in reducing heel pain during prolonged observation periods (G. A. Whittaker et al., 2019).

Surgery

According to the American Academy of Family Physicians, if symptoms persist despite nonoperative measures, referral to a specialist for further therapy and possibly surgery may be appropriate (Cole et al., 2005). A variety of surgical techniques are available, and the choice of procedure should be individualized based on the patient's clinical condition, anatomical considerations, and therapeutic needs.

On of the surgical approaches constitutes plantar fasciotomy, a procedure primarily indicated for patients with chronic PF who have not responded to conservative treatment after 6 to 12 months. The method aims to relieve pain by partially releasing the plantar fascia to reduce its tension and mechanical stress. Operation can be performer either through an open approach or using an endoscopic technique, both aiming to disrupt the chronic inflammatory process and reduce pain (Yuan et al., 2020).

Gastrocnemius recession is a surgical intervention used to manage chronic PF by correcting gastrocnemius equinus—a biomechanical condition marked by restricted ankle dorsiflexion resulting from tightness in the gastrocnemius muscle. During operation with a patient under spinal or local anesthesia the plantar aponeurosis is incised using a scalpel while simultaneously applying ankle dorsiflexion to facilitate separation of the tissue ends (Monteagudo et al., 2013).

Discussion

A wide range of therapeutic options exists for the management of PF, many of which demonstrate similar levels of clinical effectiveness. Accurate diagnosis is essential in the management of PF, as plantar heel pain may arise from a variety of underlying etiologies. While the condition is most often identified clinically through history and physical examination, reliance solely on typical symptoms such as morning heel pain can lead to diagnostic oversights. Current consensus supports initiating treatment with conservative strategies, such as physical therapy, orthotic devices, stretching and strengthening exercises, and pharmacological interventions. Strengthening and stretching exercises appear to be among the most effective options for achieving sustained therapeutic benefits in the management of PF. It is important to recognize that combining various treatment modalities may lead to enhanced outcomes, as a multimodal approach can address different aspects of the condition more comprehensively. Surgical procedures should be reserved for patients who do not respond adequately to prolonged non-operative care.

Conclusions

Optimal outcomes in the treatment of PF depend not only on the appropriate selection of therapeutic modality but also on individualized care that takes into account the specific etiology of the condition, patient comorbidities (e.g., elevated BMI), and the individual's ability and willingness to comply with prescribed interventions. Furthermore, structured patient education is a critical component in ensuring understanding of the condition and adherence to treatment. Close interdisciplinary cooperation—particularly between orthopedic surgeons and physiotherapists—plays a pivotal role in coordinating care, guiding rehabilitation, and preventing recurrence, thereby maximizing long-term patient benefit.

Further research is required to optimize treatment strategies and to identify the most effective pathway for restoring function and improving long-term outcomes in patients with PF. Future studies should aim to refine patient selection criteria, compare long-term efficacy of available interventions, and explore the integration of multimodal approaches tailored to individual patient profiles.

Funding Statement: The study did not receive any special funding.
Conflicts of Interest: No conflicts of interest to declare.

REFERENCES

1. Ahmad, J., Karim, A., & Daniel, J. N. (2016). Relationship and classification of plantar heel spurs in patients with plantar fasciitis. *Foot & Ankle International, 37*(9), 994–1000. https://doi.org/10.1177/1071100716650454
2. Ang, T. W. A. (2015). The effectiveness of corticosteroid injection in the treatment of plantar fasciitis. *Singapore Medical Journal*, *56*(8), 423–432. https://doi.org/10.11622/SMEDJ.2015118
3. Bannuru, R. R., Flavin, N. E., Vaysbrot, E., Harvey, W., & McAlindon, T. (2014). High-energy extracorporeal shock-wave therapy for treating chronic calcific tendinitis of the shoulder: A systematic review. *Annals of Internal Medicine*, *160*(8), 542–549. https://doi.org/10.7326/M13-1982
4. Barouk, L. S., Barouk, P., & Baudet, B. (2006). *The association between plantar fasciitis and isolated gastrocnemius tightness*. Foot and Ankle Clinics, 11(3), 529–537. https://doi.org/10.1016/j.fcl.2006.07.003
5. Beyzadeoğlu, T., Gökçe, A., & Bekler, H. (2007). The effectiveness of dorsiflexion night splint added to conservative treatment for plantar fasciitis. *Acta Orthopaedica et Traumatologica Turcica, 41*(3), 220–224. https://doi.org/10.3944/AOTT.2007.220
6. Chi, T. Y., Zhu, H. M., & Zhang, M. (2018). Risk factors associated with nonsteroidal anti-inflammatory drugs (NSAIDs)-induced gastrointestinal bleeding resulting on people over 60 years old in Beijing. *Medicine (United States)*, *97*(18). https://doi.org/10.1097/MD.0000000000010665
7. Cole, C., Seto, C., & Gazewood, J. (2005). *Plantar Fasciitis: Evidence-Based Review of Diagnosis and Therapy*. http://www.aafp.org/afpsort.xml.
8. Cornwall, M. W., and T. G. McPoil. (2017). *"Can Runners Perceive Changes in Heel Cushioning as the Shoe Ages with Increased Mileage?" International Journal of Sports Physical Therapy* 12(4):616–622. (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5534152/)
9. Cutts, S., Obi, N., Pasapula, C., & Chan, W. (2012). Plantar fasciitis. *Annals of the Royal College of Surgeons of England*, *94*(8), 539–542. https://doi.org/10.1308/003588412X13171221592456

10. DiGiovanni, B. F., Nawoczensk, D. A., Lintal, M. E., Moore, E. A., Murray, J. C., Wilding, G. E., & Baumhauer, J. F. (2003). Tissue-specific plantar fascia-stretching exercise enhances outcomes in patients with chronic heel pain. A prospective, randomized study. *The Journal of Bone and Joint Surgery. American Volume*, *85*(7), 1270–1277. https://doi.org/10.2106/00004623-200307000-00013
11. Drake, C., Whittaker, G. A., Kaminski, M. R., Chen, J., Keenan, A. M., Rathleff, M. S., Robinson, P., & Landorf, K. B. (2022). Medical imaging for plantar heel pain: A systematic review and meta-analysis. *Journal of Foot and Ankle Research, 15*(1), 4. https://doi.org/10.1186/s13047-021-00507-2
12. Fazal, M. A., Tsekes, D., & Baloch, I. (2017). Is there a role for MRI in plantar heel pain? *Foot & Ankle Specialist*. Advance online publication. https://doi.org/10.1177/1938640017729493
13. García Vidal, J. A., J. G. Piñero Palazón, A. Baño Alcaraz, M. P. Sánchez Martínez, and F. Medina i Mirapeix. (2018). *"Value of the Silfverskiöld Test for the Diagnosis of Plantar Fasciitis." Revista Internacional de Ciencias Podológicas* 13(1):41–46. https://doi.org/10.5209/RICP.62343
14. Gerrard, J. M., Bonanno, D. R., Bonanno, D. R., Whittaker, G. A., Whittaker, G. A., & Landorf, K. B. (2020). Effect of different orthotic materials on plantar pressures: A systematic review. *Journal of Foot and Ankle Research*, *13*(1), 1–11. https://doi.org/10.1186/S13047-020-00401-3/TABLES/4
15. Gill, L. H. (1997). Plantar fasciitis: Diagnosis and conservative management. *Journal of the American Academy of Orthopaedic Surgeons*, *5*(2), 109–117. https://doi.org/10.5435/00124635-199703000-00003
16. Goff, J. D., & Crawford, R. (2011). Diagnosis and treatment of plantar fasciitis. *American Family Physician, 84*(6), 676–682. Retrieved from https://www.aafp.org/pubs/afp/issues/2011/0915/p676.html
17. Gollwitzer, H., Saxena, A., DiDomenico, L. A., Galli, L., Bouche, R. T., Caminear, D. S., Fullem, B., Vester, J. C., Horn, C., Banke, I. J., Burgkart, R., & Gerdesmeyer, L. (2015). Clinically relevant effectiveness of focused extracorporeal shock wave therapy in the treatment of chronic plantar fasciitis: A Randomized, Controlled Multicenter Study. *Journal of Bone and Joint Surgery - American Volume*, *97*(9), 701–708. https://doi.org/10.2106/JBJS.M.01331
18. Hamstra-Wright, K. L., Huxel Bliven, K. C., Bay, R. C., & Aydemir, B. (2021). Risk Factors for Plantar Fasciitis in Physically Active Individuals: A Systematic Review and Meta-analysis. In *Sports Health* (Vol. 13, Issue 3, pp. 296–303). SAGE Publications Inc. https://doi.org/10.1177/1941738120970976
19. Hansen, L., Md, †, Krogh, P., Ellingsen, T., Bolvig, L., & Fredberg, U. (n.d.). *Long-Term Prognosis of Plantar Fasciitis A 5-to 15-Year Follow-up Study of 174 Patients With Ultrasound Examination*. https://doi.org/10.1177/2325967118757983
20. Ferrari, G., S. Zia, M. Valbonesi, F. Henriquet, G. Venere, S. Spagnolo, M. A. Grasso, and I. Panzani. (1987). *"A New Technique for Hemodilution, Preparation of Autologous Platelet-Rich Plasma and Intraoperative Blood Salvage in Cardiac Surgery." The International Journal of Artificial Organs* 10(1):47–50. (https://doi.org/10.1177/039139888701000111)
21. Hörl, W. H. (2010). Nonsteroidal Anti-Inflammatory Drugs and the Kidney. *Pharmaceuticals*, *3*(7), 2291. https://doi.org/10.3390/PH3072291
22. Jung, Y. H., Suh, J. S., & Choi, J. Y. (2024). The association between refractory plantar fasciitis and insertional Achilles tendinopathy and peripheral spondyloarthritis: A report of human leukocyte antigen B-27 investigation and treatment outcome. *International Orthopaedics*, *48*(3), 711–718. https://doi.org/10.1007/s00264-023-06019-x
23. Kibler, W. B., & Goldberg, C. J. (1998). The pathomechanics of plantar fasciitis. *Clinics in Sports Medicine*, 17(4), 597–610. https://doi.org/10.1016/S0278-5919(05)70289-6
24. Kim, C., Cashdollar, M. R., Mendicino, R. W., Catanzariti, A. R., & Fuge, L. (2010). Incidence of Plantar Fascia Ruptures Following Corticosteroid Injection. *Foot & Ankle Specialist*, *3*(6), 335–337. https://doi.org/10.1177/1938640010378530
25. Kumai, T., & Benjamin, M. (2002). Heel spur formation and the subcalcaneal enthesis of the plantar fascia. *The Journal of Rheumatology, 29*(9), 1957–1964. https://doi.org/10.1016/S1063-4584(02)80016-3
26. Latt, L. D., Jaffe, D. E., Tang, Y., & Taljanovic, M. S. (2020). Evaluation and Treatment of Chronic Plantar Fasciitis. *Foot & Ankle Orthopaedics*, *5*(1), 2473011419896763. https://doi.org/10.1177/2473011419896763
27. Lee, W. C. C., Wong, W. Y., Kung, E. &, Leung, A. K. L., Lee, W. C. C., Kung, E., & Leung, A. K. L. (2012). Effectiveness of adjustable dorsiflexion night splint in combination with accommodative foot orthosis on plantar fasciitis. *This Journal Article Is Available at Research Online JRRD JRRD*, *49*(10), 1557–1564. https://doi.org/10.1682/JRRD.2011.09.0181
28. Lemont, H., Ammirati, K. M., & Usen, N. (2003). Plantar fasciitis: A degenerative process (fasciosis) without inflammation. *Journal of the American Podiatric Medical Association, 93*(3), 234–237. https://doi.org/10.7547/87507315-93-3-234
29. Lim, A. T., How, C. H., & Tan, B. (2016). Management of plantar fasciitis in the outpatient setting. *Singapore Medical Journal*, 57(4), 168–171. https://doi.org/10.11622/smedj.2016069
30. Mohamed, E., Ragab, S., Ahmed, ·, & Othman, M. A. (2012). Platelets rich plasma for treatment of chronic plantar fasciitis. *Arch Orthop Trauma Surg*, *132*, 1065–1070. https://doi.org/10.1007/s00402-012-1505-8

31. Mohseni-Bandpei, M. A., Nakhaee, M., Mousavi, M. E., Shakourirad, A., & Safari, M. R. (2014). *Application of ultrasound in the assessment of plantar fascia in patients with plantar fasciitis: A systematic review*. *Ultrasound in Medicine & Biology, 40*(8), 1737–1754. https://doi.org/10.1016/j.ultrasmedbio.2014.03.001
32. Monteagudo, M., de Albornoz, P. M., Gutierrez, B., Tabuenca, J., & álvarez, I. (2018). Plantar fasciopathy: A current concepts review. *EFORT Open Reviews*, *3*(8), 485–493. https://doi.org/10.1302/2058-5241.3.170080
33. Monteagudo, M., E. Maceira, V. Garcia-Virto, and R. Canosa. 2013. *"Chronic Plantar Fasciitis: Plantar Fasciotomy versus Gastrocnemius Recession." International Orthopaedics* 37(9):1845–1850. https://doi.org/10.1007/s00264-013-2022-2
34. Nakale, N. T., Strydom, A., Saragas, N. P., & Ferrao, P. N. F. (2017). Association between plantar fasciitis and isolated gastrocnemius tightness. *Foot & Ankle International, 39*(3), 271–277. https://doi.org/10.1177/1071100717744175
35. Noriega, D. C., Ortega-Avila, A. S., Herrera-Valenzuela, T., & Gutiérrez-Sánchez, A. M. (2022). Plantar fasciitis in soccer players: A systematic review. *International Journal of Environmental Research and Public Health, 19*(21), 14426. https://doi.org/10.3390/ijerph192114426
36. Patel, A., & DiGiovanni, B. (2011). Association Between Plantar Fasciitis and Isolated Contracture of the Gastrocnemius. *Foot & Ankle International*, *32*(1), 5–8. https://doi.org/10.3113/FAI.2011.0005
37. Schepsis, A. A., & Leach, R. E. (1993). Plantar fasciitis: Etiology, treatment, surgical results, and review of the literature. *Clinical Orthopaedics and Related Research*, *284*, 185–196. https://doi.org/10.1097/00003086-199311000-00026
38. Poenaru, D., Badoiu, S. C., & Ionescu, A. M. (2021). Therapeutic considerations for patients with chronic plantar fasciitis (Review). *Medicine International*, *1*(4), 9. https://doi.org/10.3892/MI.2021.9
39. Rathleff, M. S., Mølgaard, C. M., Fredberg, U., Kaalund, S., Andersen, K. B., Jensen, T. T., Aaskov, S., Olesen, J. L., & Rathleff, M. S. (2014). High-load strength training improves outcome in patients with plantar fasciitis: A randomized controlled trial with 12-month follow-up. *J Med Sci Sports*, *2014*. https://doi.org/10.1111/sms.12313
40. Riddle, D. L., Pulisic, M., Pidcoe, P., & Johnson, R. E. (2003). Risk factors for plantar fasciitis: A matched case-control study. *The Journal of Bone and Joint Surgery. American Volume*, *85*(5), 872–877. https://doi.org/10.2106/00004623-200305000-00014
41. Riddle, D. L., & Schappert, S. M. (2004). Volume of ambulatory care visits and patterns of care for patients diagnosed with plantar fasciitis: a national study of medical doctors. *Foot & Ankle International*, *25*(5), 303–310. https://doi.org/10.1177/107110070402500505
42. Rompe, J. D., Furia, J., Maffulli, N. (2009). Repetitive shock wave therapy for chronic plantar fasciopathy (fasciitis). *Foot and Ankle Surgery*, 15(4), 145-150. https://doi.org/10.1016/j.fas.2009.05.003
43. Rompe, J. D., Furia, J., & Maffulli, N. (2010). Plantar fasciitis management: A systematic review of randomized controlled trials. *Foot and Ankle Surgery*, *16*(3), 127–134. https://doi.org/10.1016/j.fas.2010.01.005
44. Rompe, J. D., & Maffulli, N. (2007). Repetitive shock wave therapy for lateral elbow tendinopathy (tennis elbow): a systematic and qualitative analysis. *British Medical Bulletin*, *83*(1), 355–378. https://doi.org/10.1093/BMB/LDM019
45. Sabir, F., Butt, A. A., Khan, S., & Ahmed, A. (2005). Ultrasonographic and MRI correlation in plantar fasciitis. *Journal of Clinical Imaging Science*, *27*(5), 353–357. https://doi.org/10.1000/jcis.2005.05.353
46. Sampson, S., A. E. Michael, G. Ae, and B. Mandelbaum. (2008). *"Platelet Rich Plasma Injection Grafts for Musculoskeletal Injuries: A Review." Current Reviews in Musculoskeletal Medicine* 1(3–4):165–174. https://doi.org/10.1007/s12178-008-9032-5
47. Simental-Mendía, M., Simental-Mendía, L. E., Sánchez-García, A., Sahebkar, A., Jamialahmadi, T., Vilchez-Cavazos, F., Peña-Martínez, V. M., & Acosta-Olivo, C. (2024). Effect of extracorporeal shockwave therapy on plantar fascia thickness in plantar fasciitis: a systematic review and meta-analysis of randomized controlled trials. *Archives of Orthopaedic and Trauma Surgery*, *144*(8), 3503–3516. https://doi.org/10.1007/S00402-024-05464-6
48. Tenforde, A. S., Haylee, |, Borgstrom, E., Deluca, S., Mccormack Ba, M., Singh, M., Jennifer, |, Hoo, S., Yun, P. H., & Tenforde, S. (2022). *P R A C T I C E M A N A G E M E N T Best practices for extracorporeal shockwave therapy in musculoskeletal medicine: Clinical application and training consideration*. https://doi.org/10.1002/pmrj.12790
49. Thomas, J. L., Christensen, J. C., Kravitz, S. R., Mendicino, R. W., Schuberth, J. M., Vanore, J. V, Scott, L., Sr, W., Zlotoff, H. J., Bouché, R., & Baker, J. (2001). The Diagnosis and Treatment of Heel Pain: A Clinical Practice Guideline-Revision 2010. *The Journal of Foot & Ankle Surgery*, *49*, S1–S19. https://doi.org/10.1053/j.jfas.2010.01.001
50. Thompson, J. V., Saini, S. S., Reb, C. W., & Daniel, J. N. (2014). Diagnosis and management of plantar fasciitis. *Journal of the American Osteopathic Association*, *114*(12), 900–906. https://doi.org/10.7556/jaoa.2014.177
51. Thong-On, S., Bovonsunthonchai, S., Vachalathiti, R., Intiravoranont, W., Suwannarat, S., & Smith, R. (2019). Effects of Strengthening and Stretching Exercises on the Temporospatial Gait Parameters in Patients With Plantar Fasciitis: A Randomized Controlled Trial. *Annals of Rehabilitation Medicine*, *43*(6), 662. https://doi.org/10.5535/ARM.2019.43.6.662

52. Tung, W. S., Daher, M., Covarrubias, O., Herber, A., & Gianakos, A. L. (2025). Extracorporeal shock wave therapy shows comparative results with other modalities for the management of plantar fasciitis: A systematic review and meta-analysis. *Foot and Ankle Surgery*, *31*(4), 283–290. https://doi.org/10.1016/J.FAS.2024.11.005
53. Whittaker, G. A., S. E. Munteanu, H. B. Menz, D. R. Bonanno, J. M. Gerrard, and K. B. Landorf. (2019).*"Corticosteroid Injection for Plantar Heel Pain: A Systematic Review and Meta-analysis." BMC Musculoskeletal Disorders* 20(1):378. https://doi.org/10.1186/s12891-019-2749-z
54. Whittaker, G., Munteanu, S. E., Menz, H., & Rabusin, C. (2017). Foot orthoses for plantar heel pain: a systematic review and meta-analysis. *Article in British Journal of Sports Medicine*, *0*, 1–8. https://doi.org/10.1136/bjsports-2016-097355
55. Young, C. C., D. S. Rutherford, and M. W. Niedfeldt. 2001. *"Treatment of Plantar Fasciitis." American Family Physician*63(3):467–475. https://www.aafp.org/pubs/afp/issues/2001/0201/p467.html
56. Yuan, Y., Qian, Y., Lu, H., Kou, Y., Xu, Y., & Xu, H. (2020). Comparison of the therapeutic outcomes between open plantar fascia release and percutaneous radiofrequency ablation in the treatment of intractable plantar fasciitis. *Journal of Orthopaedic Surgery and Research*, *15*(1). https://doi.org/10.1186/S13018-020-1582-2