Spring 5-14-2018

Physical Therapy Interventions for Runners Experiencing Plantar Fasciitis: An Evidence Based Analysis

Zach Chenoweth
University of New Mexico

Physical Therapy Interventions for Runners Experiencing Plantar Fasciitis: An Evidence Based Analysis

By:
Zach Chenoweth
Doctoral Candidate
University of New Mexico School of Medicine
Division of Physical Therapy
Class of 2018

Advisor:
Marybeth Barkocy, PT, DPT, PCS

Table of Contents

Abstract…….3

Section I: Background and Purpose……..4

Section II: Case Description……..6

Section III: Evidence Based Analysis……8

Search Methodology and Articles Included……...8

Systematic Literature Review Process……9

Article Summaries……..11

Discussion……...20

Conclusion……..24

Appendix A: Article Analysis Worksheets……25

Appendix B: Table of Articles……...57

References……..61

Abstract:

Purpose: The goal of this review was to analyze evidence-based research in an attempt to answer the PICO question: For runners experiencing plantar fasciitis, what is considered the best physical therapy intervention to reduce pain?

Background: Running is a common form of exercise and recreation enjoyed by many people. Injuries often plague runners and of those, plantar fasciitis, an overuse injury to the plantar aponeurosis, is common as it affects roughly 10% of runners.

Case Description: The patient was a 22-year-old former college cross country runner training for his first marathon. During training, he noticed pain in his heel but did not think much of it and continued training. He started the marathon, but just past half-way had to drop out due to a significant increase in pain. He went to urgent care and then later to a podiatrist, finding out he partially torn his plantar fascia. After spending 6 weeks in a walking boot, during which time he did not receive physical therapy, he was slowly allowed to return to running.

Methods: A search using multiple databases was completed to find physical therapy interventions used in the treatment of plantar fasciitis to see if anything could have been done when the pain first appeared to prevent the more serious injury and potentially allowed the patient to finish the race.

Discussion: There are many current treatment options for individuals experiencing pain from plantar fasciitis including manual therapy, therapeutic exercise, modalities, and mechanical interventions. Each has proven beneficial in reducing pain in those individuals making it difficult to answer the PICO question. Because of this, it is important for there to be more research done looking at comparing the treatment techniques to get a better idea of the benefit each has in reducing pain in both the short and long term.

Section I: Background and Purpose

Running is a popular, and relatively cheap form of exercise for many individuals. The USATF published a report in 2002 that "nearly 10.5 million Americans ran 100 or more days." The number of finishers for races in the United States for 2016 was reported at just under 17 million. Although this was a decline from previous years (the peak being around 19 million finishers in 2013), it is still over a three and a half time increase from the just under 4.8 million who finished a race in 1990 (Running USA, 2017). With this increase in total participants, there has also been a shift in the proportions of who is running as in 1990 a majority was male (75%), whereas now there are slightly more women finishing (57%).

As with any sport, there is always the risk for injury. In a systematic review looking at the incidence of running related injuries, Videbæk et al. (2015) found there were 7.7 and 17.8 injuries sustained per 1000 hours for recreational runners and novice runners respectively. The estimates could not be calculated on ultra-marathon and track and field athletes due to the limitation in number of studies found. In the few studies available, incidences ranged from 2.5 to 26.3 per 1000 hours. In an article on Complete Track and Field, Christensen (2017) reported 37% to 56% of runners experienced an injury per year. Of these injuries, 70-80% occur between the knee and the foot and of the most common running related injuries seen, plantar fasciitis ranked number 5, contributing to 6.7% of the injuries (Christensen, 2017). Dias Lopes, Hespanhol Junior, Yeung, and Pena Costa (2012) found the incidence of plantar fasciitis to be 4.5% to 10% and the prevalence to be 5.2% to 17.5%. In a Runner's World survey, Aschwanden (2017) reported a similar rate as 10 percent of runners had experienced plantar fasciitis in the past year.

Plantar fasciitis is an overuse injury to the plantar aponeurosis. The pain is often felt on the plantar aspect of the foot, near the medial calcaneal tubercle where the plantar aponeurosis inserts. Although the pain can decrease throughout the day from the first steps in the morning when it is often considered most painful, prolonged periods of walking or running can also increase the pain again. (Levangie & Norkin, 2015; Magee, 2008). The plantar aponeurosis is fascia that extends the whole length of the foot (Drake, Mitchell, & Vogl, 2010; Levangie & Norkin, 2015; Magee, 2008). The role of the aponeurosis is to help support the arch as it helps transmit the force from the Achilles tendon to the forefoot through the gait cycle, specifically from the beginning to end of the stance phase (Levangie & Norkin, 2015). Ribeiro et al. (2015) found during running, the load in the plantar fascia was higher for those experiencing pain than in a control group without pain. Running is a sport requiring the repetitive nature of step after step, so running pain free is paramount.

As plantar fasciitis can be an annoying and nagging injury to have for a runner trying to train for a race, a simple Google search turns up multiple results to running related websites with various home-based treatment options. Therefore, the purpose of this present study was to review the literature for various physical therapy interventions and find for runners experiencing plantar fasciitis, what is considered the best treatment to reduce pain?

Section II: Case Description

The patient was a former collegiate runner, who had been training for his first marathon. The marathon was in mid-October and he had been training since about mid to late June. He was running around 60-65 miles a week. As this was his first experience at the longer distances he joined a local running group to help guide him with the training and workouts.

Training was going well, and in early September, he surprised himself with a decent debut in the half marathon. He returned to training even more invigorated as he thought he now had a chance to go under 2:50 in his debut marathon. During these last few weeks, though, he started to notice he was having some pain in his left foot at the base near the heel. This pain was usually when he initially bore weight with his first steps in the morning and again during the first steps of a run. He reported he had "self-diagnosed" plantar fasciitis in college, which worked itself out by taking a few days off and backing off in the mileage. Due to a similarity of symptoms, he thought this was the same. As he was nearing the race though, he felt he could not take any time off as that would negatively affect his fitness and his ability to perform well.

Come race day, though, he felt ready to go despite having the continued discomfort every so often in his foot. At about mile 6, he felt the discomfort and slight pain return in his left foot. This was slightly different in it not being at the beginning of his run. He did not think much of it as it was a marathon, and he assumed he was supposed to be hurting. Just past mile 14 though, with one step, the pain went from a dull ache to a sharp, stabbing pain, sort of like he had stepped on a sharp rock. He thought he felt a pop or snap in his foot, and with the next few steps and continued high pain, knew his race was over.

That day he went to urgent care where the doctor said it was plantar fasciitis and gave him crutches to help stay off of it. Later in the week he went to a podiatrist who said he had a

partially torn plantar fascia. He was given a walking boot and recommendations of rest for 6 weeks, after which time he could slowly return to running. The patient was not seen for physical therapy at any point for the duration of the injury. Had he received physical therapy when the pain first started though, could he have prevented the tear and finished the race with decreased pain?

Section III: Evidence Based Analysis

Search Methodology:

A literature search was done to answer the following PICO question: For runners experiencing plantar fasciitis, what is considered the best physical therapy intervention to reduce pain? The databases searched included PEDro, SPORTDiscus, and PubMed. Search terms were identical for each database and included the terms: "plantar fasciitis," "plantar fasciitis AND run*," "plantar fasciitis AND physical therapy," and "plantar fasciitis AND run* AND physical therapy." Slightly more specific searches were used on SPORTDiscus to identify other possible treatment options and included "plantar fasciitis AND strength*," "plantar fasciitis AND mobilization," and "plantar fasciitis AND orthoses." Articles were selected based off their title and abstract and ability to give a wide range of possible treatment options for the controlling of pain associated with plantar fasciitis.

The articles from the search were identified were as follows:

1. Celik, Kus, & Sirma (2016)
2. Kamonseki, Goncalves, Yi, & Junior (2016)
3. Rathleff et al (2015)
4. Costantino, Vulpiani, Romiti, Vetrano, & Saraceni (2014)
5. Rompe, Decking, Schoellner, & Nafe (2003)
6. Podolsky & Kalichaman (2015)
7. Roos, Engstrom, & Soderberg (2006)
8. Ryan, Fraser, McDonald, & Taunton (2009)

Table 1. Systematic Literature Review Process:

Search Terms	Number of Articles	Included/Excluded
PEDro		
Plantar fasciitis	122	Too many
Plantar fasciitis AND run*	6	4 selected based on relevance of title related to PICO question, 1 excluded too old (>15 years old), 1 excluded based on lack of relevance
Plantar fasciitis AND physical therapy	29	2 already used, others excluded based on lack of relevance and trying to include multiple treatment options
Plantar fasciitis AND run* AND physical therapy	2	2 already identified
SPORTDiscus Limited to full text, less then 15 years old		
Plantar fasciitis	163	Too many
Plantar fasciitis AND run*	52	All excluded based on other previously identified and lack of relevance
Plantar fasciitis AND physical therapy	26	1 selected based on relevance to PICO question, others excluded based on lack of relevance and trying to include multiple treatment options
Plantar fasciitis AND run* AND physical therapy	6	All excluded based on lack of relevance, 1 included for background
Plantar fasciitis AND strength*	25	2 included, others excluded based on lack of relevance
Plantar fasciitis AND mobilization	11	1 included, others excluded based on lack of relevance
Plantar fasciitis AND orthoses	11	1 included, others excluded based on lack of relevance/already identified
PubMed Limited to full text, less then 15 years old, humans		
Plantar fasciitis	684	Too many

Plantar fasciitis AND run*	6	Excluded based on repeats/lack of relevance
Plantar fasciitis AND physical therapy	176	Too many
Plantar fasciitis AND run* AND physical therapy	2	Articles previously identified

Article Summaries:

Reference #1:

Celik, D., Kuş, G., & Sırma, S. Ö. (2016). Joint mobilization and stretching exercise vs steroid injection in the treatment of plantar fasciitis: a randomized controlled study. *Foot & ankle international*, *37*(2), 150-156.

Oxford Score: 2b **PEDro Score:** 7/10

Purpose: The purpose of this study was to look at how effective joint mobilization combined with stretching exercises was for the treatment of plantar fasciitis compared to a steroid injection.

Methods: 43 participants were assigned to one of two groups. The joint mobilization and stretching was done 3 times a week for 3 weeks and the steroid injection was given once at baseline. The outcomes looked at were pain using the Visual Analog Scale (VAS) and function using the Foot and Ankle Ability Measure (FAAM). These were taken at baseline, 3-week, 6-week, 12-week, and 1 year post intervention.

Results: Significant improvement was seen in both groups at 3, 6, and 12-week follow-up for both pain relief and functional outcomes compared to baseline. At the 12-week and 1 year follow-up, pain and function was only better in the joint mobilization and stretching group although not significantly. When comparing the groups, the steroid injection group had significantly better outcomes in pain and function at 3, 6, and 12 week follow-ups but no difference was seen at 1 year.

Bottom Line: Joint mobilization with stretching and steroid injections were both proven to be effective in the management of individuals experiencing plantar fasciitis. Although the injections have the inherent risk of spontaneous rupture, they proved beneficial in providing more rapid

pain relief and increase in function in the short term while the joint mobilization with stretching had long benefits.

Reference #2:

Kamonseki, D. H., Gonçalves, G. A., Liu, C. Y., & Júnior, I. L. (2016). Effect of stretching with and without muscle strengthening exercises for the foot and hip in patients with plantar fasciitis: a randomized controlled single-blind clinical trial. *Manual therapy*, *23*, 76-82.

Oxford Score: 2b **PEDro Score:** 8 /10

Purpose: The purpose of this study was to compare stretching with and without muscle strengthening of the foot alone or of the foot and hip in patients with plantar fasciitis.

Methods: 83 participants were randomized into three groups (Foot Exercise Group, Foot and Hip Exercise Group, and Stretching Alone Exercise Group). Treatment was done for 8 weeks with the outcomes being looked at the start and end of those weeks including the VAS for pain, the Foot and Ankle Outcome Score (FAOS), and the Star Excursion Balance Test (SEBT).

Results: Significant improvements were seen in all groups with the VAS, all subscales of the FAOS, and for posterolateral movement, posteromedial movement, and composite score for the SEBT (all except anterior movement). There was no difference seen when comparing the group at the two times (pre and post).

Bottom Line: Following the 8-week intervention, each of the 3 groups saw significant improvements in pain, function, and dynamic lower limb stability. No group was proven to be more effective than the other at treating individuals experiencing plantar fasciitis.

Reference #3:

Rathleff, M. S., Mølgaard, C. M., Fredberg, U., Kaalund, S., Andersen, K. B., Jensen, T. T., Aaskov, S., & Olesen, J. L. (2015). High-load strength training improves outcome in patients with plantar fasciitis: A randomized controlled trial with 12-month follow-up. *Scandinavian journal of medicine & science in sports*, *25*(3), 1-9.

Oxford Score: 2b **PEDro Score:** 6 /10

Purpose: The purpose of this study was to compare shoe inserts and plantar fascia-specific stretching with shoe inserts and high-load strength training for individuals with plantar fasciitis.

Methods: 48 patients were randomized into either the stretch group (completed daily for 3 months) or the strength group (completed every second day). The primary outcome being looked at the Foot Function Index (FFI) and was taken at baseline, 1, 3, 6, and 12 months. Other outcomes included thickness of the plantar fascia, foot pain at worst, foot pain at first step in morning, satisfaction with results, physical activity level, and average leisure time sports participation.

Results: At 3 months, the strength group saw a significant difference in FFI score compared to the stretch group. There was no significant difference at the other time periods in FFI score. The stretch group did have a slightly better FFI score at 12 months. For secondary outcomes, the strength group reported foot pain which was not as intense at 3 months and were more satisfied at 3 and 12 months.

Bottom Line: The high-load strengthening proved effective in improving the score of FFI at 3 months while at the other time intervals, the stretch group and strength group saw similar results. This means that both, in combination with the shoe insert, help improve function as related to the FFI with the strength group showing better short-term results.

Reference #4:

Costantino, C., Vulpiani, M. C., Romiti, D., Vetrano, M., & Saraceni, V. M. (2014). Cryoultrasound therapy in the treatment of chronic plantar fasciitis with heel spurs. A randomized controlled clinical study. *European journal of physical and rehabilitation medicine*, *50*(1), 39-47.

Oxford Score: 1b **PEDro Score:** 8/10

Purpose: The purpose of the study was to compare cryoultrasound and cryotherapy in the treatment of patients with chronic plantar fasciitis with heel spurs.

Methods: 84 participants meeting the inclusion criteria were randomized into the cryoultrasound therapy or cryotherapy treatment group. Treatment was given for 10 daily sessions lasting 20 minutes. Pain using the VAS was taken before the treatment and then again at 3, 12, and 18 months following the treatment intervention.

Results: Both cryoultrasound and cryotherapy were shown effective as both saw decreases in pain. Out of the two though, cryoultrasound was shown to be better as there was a larger decrease in pain seen at each follow-up interval where the VAS was recorded.

Bottom Line: Cryoultrasound is an effective tool and treatment option for patients experiencing chronic plantar fasciitis with heel spurs and has lasting effects seen a year and a half following treatment.

Reference #5:

Rompe, J. D., Decking, J., Schoellner, C., & Nafe, B. (2003). Shock wave application for chronic plantar fasciitis in running athletes. *The American journal of sports medicine*, *31*(2), 268-275.

Oxford Score: 2b **PEDro Score:** 7/10

Purpose: The purpose of the study was to look at the effect low-energy electromagnetic application of extracorporeal shock waves had in reducing pain in runners with chronic plantar fasciitis.

Methods: 45 runners were randomized into one of two groups: the shockwave and sham treatment groups. Treatment consisted of 3 applications of low-energy shock waves at a predetermined intensity. Examinations were performed at baseline, 6 months, and at 1 year following treatment. The main outcome was pain on first walking in the morning using the VAS. The American Orthopedic Foot and Ankle Society's Ankle-Hindfoot Scale was also used as a secondary outcome.

Results: Although the scores for both groups decreased, there was a significant difference in the rating of pain on first walking at 6 months and 1 year in favor of the shock wave group. There was also a significant improvement in the Ankle-Hindfoot Scale for the shock wave group.

Bottom Line: Both groups showed improvements in pain and their rating of pain and function using the Ankle-Hindfoot Scale at both 6 months and 1 year, but it was only significant for the shock wave treatment group. This showed, despite reports of being uncomfortable during the treatment, the shock wave was able to provide effective treatment for chronic plantar fasciitis.

Reference #6:

Podolsky, R., & Kalichman, L. (2015). Taping for plantar fasciitis. *Journal of back and musculoskeletal rehabilitation*, *28*(1), 1-6.

Oxford Score: 2a **PEDro Score:** N/A

Purpose: The purpose of this review was to look at the existing literature and the efficacy various taping techniques had in reducing pain and improving function in individuals with plantar fasciitis.

Methods: Multiple databases were searched including PubMed, CINAHL, PEDro, ISI Web of Science, and Google Scholar to include articles related to plantar fasciitis and taping. Articles of any quality were included in the review and 8 studies were identified that met the predetermined inclusion criteria.

Results: Of the 8 studies, 5 were randomized control trials, 1 a cross-over study, and 2 a single group repeated measures. In each, it was found the taping method showed significant improvement in the reduction of pain in the short term.

Bottom Line: Taping is a useful treatment option for reducing pain for individuals with plantar fasciitis. From this review, low dye taping was the most common taping method researched but each of the other techniques in the study (calcaneal, plantar fasciitis, and windlass taping) also showed significant improvements in pain.

Reference #7:

Roos, E., Engström, M., & Söderberg, B. (2006). Foot orthoses for the treatment of plantar fasciitis. *Foot & ankle international*, *27*(8), 606-611.

Oxford Score: 2b **PEDro Score:** 6 /10

Purpose: The purpose of this study was to study the effects of custom foot orthoses and night splints, alone or in combination, on reducing pain in individuals with plantar fasciitis.

Methods: 43 participants were randomized into one of three groups: foot orthoses, foot orthoses plus night splint, or night splint alone. The Foot and Ankle Outcome Score (FAOS) was used with pain being considered the primary outcome which was assessed at baseline, and 6, 12, 26, and 52 weeks following the start of treatment. It was recommended both the orthosis and night splint be worn daily. Good compliance was defined as wearing the particular device at least 5 days or nights a week.

Results: Each of the three groups saw significant improvements in each of the outcomes across the span of the follow-up. There were improvements between 30-50% from baseline at 12 weeks for all three groups. When measured at 52 weeks, there was a 62% pain reduction in both foot orthoses groups while only 48% in the splint group. Compliance was also better with the orthoses group and less side effects (pressure, pain, and sleep disturbances) than the night splint group.

Bottom Line: Although both night splints and custom foot orthoses are effective at decreasing pain in individuals with plantar fasciitis, orthoses may be seen as the better treatment option for both the short and long term as it could be considered more comfortable and have better compliance.

Reference #8:

Ryan, M., Fraser, S., McDonald, K., & Taunton, J. (2009). Examining the degree of pain reduction using a multielement exercise model with a conventional training shoe versus an ultraflexible training shoe for treating plantar fasciitis. *The Physician and sportsmedicine*, *37*(4), 68-74.

Oxford Score: 3b **PEDro Score:** 4 /10

Purpose: The purpose of this study was to look at the effect a conventional training shoe or ultraflexible training shoe (specifically the Nike Free) had on the treatment of plantar fasciitis when combined with a multielement exercise model, specific to improving pain in individuals with plantar fasciitis, made up of static, dynamic, and tissue-specific stretches as well as balance exercises.

Methods: 21 subjects were randomized into one of the two shoe groups: Free or Conventional. Both participated in the same 12-week multielement exercise program. The outcome assessed was pain using the VAS and taken at baseline, 6 and 12 weeks (halfway and immediately following treatment), and at 6 months.

Results: Both the conventional shoes and the Nike Free group saw significant reductions in pain by the 6-month follow-up. The differences between the groups were not significant. Trends were suggestive of the Nike Free resulting in better improvements as there were slightly lower pain levels measured at the midpoint and immediately following treatment.

Bottom Line: The multielement exercise program helped reduce pain levels in individuals experiencing pain from plantar fasciitis. Although there was no significance, there were trends suggesting the Nike Frees provided slightly earlier reductions in pain.

Discussion:

Plantar fasciitis has many treatment options. In this current search, manual therapy (Celik et al, 2016), various therapeutic exercise (Kamonseki et al, 2016; Rathleff et al, 2015), various modalities (Costantino et al, 2014; Rompe et al, 2003; Podolsky & Kalichman, 2015), and biomechanical interventions (Roos et al, 2006; Ryan et al, 2009) were identified for the treatment and reduction of pain in individuals with plantar fasciitis. With each method, there were significant decreases in pain seen over time, proving each beneficial.

Despite these treatments proving beneficial, it is difficult to apply them directly to the current patient who was a post collegiate runner training for a marathon. All studies except for Rompe et al (2003) had subjects who were not runners. Even for Rompe et al (2003), the differences were also apparent in the subjects older age, tended to have a higher body mass index, had a longer duration of symptoms when compared to the current patient, and were running fewer miles per week. The studies' participants ended up representing more of the general population where the occurrence of plantar fasciitis was just as common as in the running population, which was approximately 10% (Kamonseki et al, 2016; Rathleff et al, 2015; Costantino et al, 2014; Podolsky & Kalichman, 2015; Roos et al, 2006; Ryan et al, 2009). As the results showed the benefits of the various techniques, it could have been advantageous for the patient to try these various methods in an attempt to help alleviate the pain.

The possible therapy interventions found in this search provided simple, yet effective ways to help work to decrease the pain. The ease at which they are done can help with the patient buy-in and willingness to do the exercises prescribed, as they do not take much time. The only treatment recommended which the patient was not willing to try was the steroid injection (Celik et al, 2016). For an athlete, a"greater risk of causing spontaneous rupture" was concerning (p.

155). Although the injection provided better reductions in pain compared to the joint mobilization and stretching, the patient would be disheartened with the increased risk as he was looking to improve and not have an increase in the severity of injury. Of the other treatments studied, the only other possible negative side effect seen was in the study by Rompe et al (2003) where "low-energy extracorporeal shock wave therapy was considered unpleasant by all participants" (p. 272), but no one discontinued therapy. In that case, the risk of potential discomfort is outweighed by the benefits seen in the reduced pain.

For Kamonseki et al (2016), Rathleff et al (2015), and Ryan et al (2009) the therapeutic exercises, such as stretching to the calf or self-release of the plantar fascia and strengthening to the intrinsic and extrinsic foot muscles, are simple and easy enough that once properly taught by a physical therapist, the patient would be able to continue these on his own. Kamonseki et al (2016) had the stretching group do 4 daily stretches in 3, 30 second sets. Rathleff et al (2015) had their stretching group do only one plantar specific stretch 10 times, for 10 seconds, 3 times a day. These both do not take much time and could easily be done during short intervals such as a commercial break and would not require much planning. The strengthening groups in the same studies just required an elastic resistance band (Kamonseki et al, 2016), which could easily be provided, and a towel (Rathleff et al, 2015). The exercise seen in the study done by Ryan et al (2009) was more involved as it included multiple components including strength, stretching, and balance, but was only done 4 times a week and required no specific equipment. Celik et al (2016) also had stretching exercises, but due to the inclusion of joint mobilization, the patient would not be able to do on his own and would require the assistance of a therapist.

Additional treatments the patient would not be able to do on his own would be the cryoultrasound (Costantino et al, 2014), low-energy shock wave (Rompe et al, 2003), or taping

(Podolsky & Kalichman, 2015). Both the cryoultrasound and shock wave would be limited to the clinic and within that, the patient would also potentially be limited to the availability of clinics which have those machines ready to use. Although taping is a simple modality and is often combined with other interventions, it requires a physical therapist skilled and knowledgeable to apply it in the correct fashion. The low dye taping technique found in most studies in the review by Pokolsky and Kalichman (2015) noted the "aim […] is to decrease medial heel pressure by lifting the navicular bone" (p. 5). By helping to change the biomechanics of the foot, this could help improve alignment which could work at deceasing pain.

Also looking to change the biomechanics of the foot was the study by Roos et al (2006) where foot orthoses were being compared to night splints. Based on prior research, the custom foot orthoses were thought to be "superior to prefabricated orthoses in reducing tension in the plantar aponeurosis" (p. 610). The orthoses can be a simple recommendation a therapist makes to the individual and provide a treatment where all that is required is it be placed in the shoe. Although not as effective as the foot orthoses, the night splint was also able to reduce the pain levels (Roos et al, 2006). For Ryan et al (2009), while including the multielement exercise mentioned previously, the main focus was comparing an ultraflexible shoe (Nike Free) to a conventional shoe. The results were not significant but showed trends toward the ultraflexible shoe providing slightly more pain relief. This was thought to possibly be a result of improving the biomechanics as the flexibility of the sole helped mimic a barefoot condition and help better control the increase in load taken on in the foot seen in walking and running. Orthoses, night splints, and shoes can be simple, and at times cheap, additions and compliments to therapy to reduce pain. The only effort they require is donning them and then not having to think about them.

With these treatments studied, it is worth noting in the design, the control group always received some form of treatment. The closest the studies came was in Rompe et al (2003) who used a sham low-energy shock wave through use of "a sound-reflecting pad […] interposed between the coupling membrane of the treatment head and the heel to absorb the shock waves" (p. 270). With this there could be a placebo affect that could alter the results. Because of the lack of there being a control group who did not receive any form of treatment, it is not known whether the natural progression of the pain in plantar fasciitis helped alleviate these symptoms, or if it was the treatment being looked at.

Aside from the studies lacking a control to see the natural progression of plantar fasciitis, another limitation found in the current research was the time frame used for follow-ups. In general, each of the studies had outcomes taken at multiple points following the treatment intervention, starting with a range from 3 weeks (Celik et at, 2016) up to 18 months (Costantino et al, 2014). Only Kamonseki et at (2016) included one follow-up which was done immediately after the 8-week intervention. Podolsky and Kalichman (2015) was a systematic review of the various taping techniques and with that was limited to the research studies identified which only had follow-ups out to 1 week. Both of these is beneficial to know though. The short-term outcomes can help provide possible interventions that can be done quickly to help relieve pain if the runner is on limited time and has a big race coming up he or she is preparing for, whereas the long-term outcomes can help provide interventions which have the continuous lasting effects of reduced pain and improved function. This contributes to the individual having continued participation in races. In spite of these limitations, these studies provided evidence into possible treatment techniques that can be done either by a physical therapist or at home once the patient has been taught the correct method.

Conclusion:

The patient discussed earlier did nothing when he first exhibited the symptoms of plantar fasciitis. Because of this, he ended up with a partial tear and had to take time off from running. From this current search, the evidence provided has shown one thing for certain: Plantar fasciitis has many potential treatment options. When looked at individually, each was proven beneficial in reducing pain in individuals with plantar fasciitis. Therefore the patient could have tried any of these options to see if there was a reduction in symptoms and could have possibly allowed him to finish the race.

Due to these many possibilities, it is difficult to answer the previously stated PICO question looking for the best physical therapy interventions to reduce pain in runners with plantar fasciitis. There is currently a need for more research looking to combine and compare various treatment techniques to see the effect they have on pain and function. Included within the research should be both short (1 to 2 weeks) and long term (a month up to a year or more) results, which can show the various benefits if the patient is looking for a quick fix or a more permanent change and improvement. Additionally, it will be important to include a control group who does not receive treatment to make sure the benefits are not just due to the time and the natural progression of symptoms.

Appendix A—Article Analysis Worksheets:
Reference #1:

Celik, D., Kuş, G., & Sırma, S. Ö. (2016). Joint mobilization and stretching exercise vs steroid injection in the treatment of plantar fasciitis: a randomized controlled study. *Foot & ankle international*, *37*(2), 150-156.

Oxford Score: 2b PEDro Score: 7/10

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	Purpose stated clearly as researchers were looking at the effectiveness of joint mobilization and stretching compared to a steroid injection for the treatment of plantar fasciitis in both the short and long term
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	Brief background information provided as incidence of plantar fasciitis is discussed as well as what current evidence has shown as being good treatment options for plantar fasciitis and where the gaps lie and how this study plans to fill those gaps with the comparison of joint mobilization and stretching to steroid injection which had not been done before

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry**	Although it states the number of participants the study ended up with, the researchers did not mention how they found them and if it was based on convenience. There was attrition as two patients dropped out of the joint mobilization and stretching group and two also dropped out of the steroid injection.

➢ **Statistical Regression**	

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
1. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	Randomly assigned subjects based on computer-generated program and individual blinded to the patient's information performing the randomization
2. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	Demographics were reported and there was no significant difference seen before the start of the trial
3. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Subjects were known to which group they were assigned as the difference in interventions could not be disguised. This could lead to potential alterations in performance by the participant which could impact the data
4. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Investigators did not know who was being assigned to which group prior to allocation as another individual did the allocation
5. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this**	Groups had different amount of treatment as the steroid injection was a one-time shot, while the joint mobilization and stretching group received one on one time for 9 visits

knowledge for the study's results?	and were instructed to complete exercises twice at home
6. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Follow-up time was sufficiently long as they looked at not only long term at 1 year, but more short term tines including 3, 6, and 12 weeks
7. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	Two subjects were lost from each group (total of 4) The authors in their statistical analysis used intention to treat analysis to make up for the lost data.
8. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	The patients were analyzed in the groups to which they were analyzed and there was intention to treat analysis for those who did not complete the study
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***
9. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI**	Pairwise comparisons demonstrated significant improvements in pain relief and functional outcomes ($p < .05$) at the 3,6, and 12 week follow ups compared to baseline. Improvements at the 12 week and 1 year were only significant in the joint mobilization and stretching group. Between group differences favored the steroid group at the 3 ($p = .001$ and .001), 6 ($p = .002$ and .001), and 12 week ($p = .008$ and .001) for both pain and functional

e. Include NNT and CI **10. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	outcomes but there was no difference seen at the one year follow up (p = .62 and .57) Both the joint mobilization and stretching and a steroid injection are effective at managing pain and improving function, with the steroid providing slightly better immediate relief and the joint mobilization having more lasting effects
11. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	The findings exceed the minimally important difference of 8 points on the Foot and Ankle Ability Measure using power calculations which they meet
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
12. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	This intervention sounds appropriate for use in terms of the joint mobilization and stretching as the steroid injection is outside the scope of practice of a PT
13. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	The study subjects were different than the patient in that they were older (average age around 46), many were female (72%), and BMI was higher (around 30), despite these differences this intervention could still be tried in that it did provide relief and a decrease in symptoms
14. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	The potential benefits outweigh the risks in using the joint mobilization and stretching option with the client, although the steroid injection may provide better immediate relief, there are more increased risks with it, such as leading to a possible spontaneous rupture
15. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	The joint mobilization and stretching fall within the patient's values and expectations and even the steroid injection does as well even though there are increased risks as he is looking for pain relief
16. Are there any threats to external validity in this study?	Yes, slightly different treatment groups compared to the patient

Reference #2:

Kamonseki, D. H., Gonçalves, G. A., Liu, C. Y., & Júnior, I. L. (2016). Effect of stretching with and without muscle strengthening exercises for the foot and hip in patients with plantar fasciitis: a randomized controlled single-blind clinical trial. *Manual therapy*, *23*, 76-82.

Oxford Score: 2b PEDro Score: 8 /10

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	Purpose clearly stated as it is to compare the effect of stretching with and without muscle strengthening of the foot alone or the foot and hip on pain and function in patients with plantar fasciitis
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	Background information provided about why strengthening of the foot was being looked at as well as the benefits of stretching. As both had previously shown beneficial, this article was done to compare the effects of both strengthening and stretching to just stretching to see which has a greater impact.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry**	High attrition rate as 29 participants were lost overall out of the initial 83 that started Participants were recruited through printed and digital media which could lead to the participants not representing the whole of the population. From the way the paper is written, it is assumed only one physical therapist was providing the same treatment and if this was the case it would be important to keep the same demeanor throughout to not encourage or discourage another group more

➢ **Statistical Regression**	

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
17. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	Subjects were randomly assigned to their treatment group
18. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	Demographics were reported as being similar and having no difference at baseline
19. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Subjects knew to which group they were assigned based on their workout they were given which could lead to either compensating and trying harder or not as hard
20. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Investigators did not know who was being assigned to which group prior to allocation as an independent researcher completed that task
21. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	The groups were managed equally apart from the experimental treatment, but with that, in each group there would be another group doing more and having more time spent on the exercises (stretching vs. foot exercise vs. foot and hip exercise)
22. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this**	The follow-up time was not sufficient as it just lasted 8 weeks, the length of the study and there was not any long term follow-up to see if there was still the benefits

knowledge for the study's results?	
23. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	No, all the subjects that were originally enrolled did not complete the study as the researchers ended up losing 29 participants, for this attrition, the authors used intention to treat analysis, which could change the outcomes and possibly downplay or enhance the results seen
24. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	The patients were analyzed to the groups into which they were allocated and in the case of the ones who were lost to attrition, their data was analyzed using intention to treat analysis
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***
25. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **26. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	Significant improvements were seen in all groups for the VAS pre and post as well as the pain, activities of daily living, sports and recreation, quality of life ($p < 0.001$) and other symptoms ($p < 0.01$) subscales of the Foot and Ankle Outcome Score. Posterior medial and posterolateral movements, and composite score on the Star Excursion Balance Test increased ($p < 0.001$), but no difference was seen in the anterior movement ($p = 0.17$). The were no time-group interactions or difference between groups over time ($p > 0.05$) Statistically, this means each of these options could prove beneficial to improving the patient's pain and could easily be implemented into the treatment of plantar fasciitis

27. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	The only minimally important difference reported was for the VAS of which the findings exceed.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
28. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	The intervention sounds appropriate for use as it is affordable as it just requires a PT for guidance but much could be potentially done with a home program once the patient learns the proper technique
29. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	The study subjects were different than the patient in that they were older (average age around 45), many were women (79%), and BMI was higher (around 30). Although it was not specified what met the criteria 50% of the participants ranked their physical activity as high which would be similar to the patient. Despite these differences this intervention could still be tried in that the intended outcome was the same in pain relief and improving function
30. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	There are no real potential risks seen from this study design as each shows the benefits of increasing pain and function
31. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	This intervention fits within the patient's values and expectations
32. Are there any threats to external validity in this study?	Yes, sample chosen was from convenience so may not represent the entire population or be applicable to the high-level athletes. There was also no control group to see the natural progression of plantar fasciitis

Reference #3:

Rathleff, M. S., Mølgaard, C. M., Fredberg, U., Kaalund, S., Andersen, K. B., Jensen, T. T., Aaskov, S., & Olesen, J. L. (2015). High-load strength training improves outcome in patients with plantar fasciitis: A randomized controlled trial with 12-month follow-up. *Scandinavian journal of medicine & science in sports*, *25*(3), 1-9.

Oxford Score: 2b PEDro Score: 6 /10

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	Purpose stated clearly as it is to investigate the effectiveness of shoe inserts and plantar fascia-specific stretching versus shoe inserts and high-load strength training in patients with plantar fasciitis
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	Background showing how plantar specific stretching and shoe inserts have proven effective. High load training has been shown effective for Achilles and patellar tendinopathy so it is thought to apply a similar principle to the treatment of plantar fasciitis.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry**	Principle investigator met with the PTs and doctors providing treatment and diagnosis at the various centers used. Although this was done to limit the potential differences, not having the same person perform each aspect causes the lack of uniformity. At follow-up, the participants were seen by the same doctor and PT to ensure uniformity.

➢ **Statistical Regression**	

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
33. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	Subjects were randomly assigned to the treatment group using a computer-generated sequence created by the main investigator
34. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	Demographics at the start of the trial appear to be similar and there was no difference between study groups
35. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Subjects knew which treatment they were receiving which could affect the amount of effort they were putting forth and how compliant they were with following through on their instructions
36. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Investigators did not know who was being assigned to which group prior to allocation as the principal investigator used a computer-generated program to allocate the subjects
37. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Groups were managed equally apart from the treatment given in they were provided the same information and guidance for treatment, as needed, although from different practitioners which could lead to potential differences between groups. Reassessments were also done by the same individual resulting in validity
38. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research?	Follow up time was completed at 1, 3, 6, and 12 months which provides a good window to see both the short and long term effects of the study intervention

a. If not, what are the potential consequences of this knowledge for the study's results?	
39. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	Multiple subjects were lost as at follow-ups it was reported it ranged from 77% to 94% and at the final endpoint there was 81% follow-up, meaning a loss of between 3 and 11 at each. The authors stated they used intention to treat analysis for the missing data, meaning the significance of the results from the study could be different than what was previously presented
40. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	Participants were analyzed for the group into which they were assigned and if the group lost someone to attrition there was intention to treat analysis performed
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***
41. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **42. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	At 3 months, the high load strength group had a FFI that was significantly better than the stretch group ($p = 0.016$) (29 point difference). At 1, 6, and 12 there was no significant difference ($p > 0.34$) (5-7 point) between groups. For secondary outcomes, the strength group reported significantly less worse foot pain at 3 months, and were more satisfied at 3 and 12 months. There were no other significant differences between groups This statistically means the strength group performed slightly better in the short term in terms of reducing pain but overall at 12 months they provided similar results

43. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	The minimal important difference for the FFI is 7 points which the results exceeded
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
44. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	The results sound appropriate for use as it required a small foot orthoses and the teaching of the exercises to the patient to perform on their own
45. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	The participants in the study were largely female (66%), older (46), and had larger BMIs (27) than the patient. Despite this difference, these results could still be utilized as there was a decrease in pain and improvement in function
46. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	The only risk mentioned with the study was potential for delayed onset muscle soreness which as a runner, the patient should be accustomed to making the benefits outweigh the risks
47. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	This intervention fits within the patient's stated values and expectations
48. Are there any threats to external validity in this study?	Yes, threats to external validity is adherence to the program was not recorded as well as the characteristics not matching up with that of the patient

Reference #4:

Costantino, C., Vulpiani, M. C., Romiti, D., Vetrano, M., & Saraceni, V. M. (2014). Cryoultrasound therapy in the treatment of chronic plantar fasciitis with heel spurs. A randomized controlled clinical study. *European journal of physical and rehabilitation medicine*, *50*(1), 39-47.

Oxford Score: 1b PEDro Score: 8/10

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	Purpose stated clearly. To evaluate the efficacy of cryoultrasound compared to cryotherapy in patients with chronic plantar fasciitis with heel spurs
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	Background information is presented with the prevalence of the condition along with possible mechanisms. Possible treatment techniques are presented and it is stated how cryoultrasound has been tested for other musculotendinous injuries and shown beneficial, making it reasonable to test it for plantar fasciitis.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments**	Selection appears to be based off of convenience as they were recruited from the university hospital. Assignment was done by a computer possibly making the groups unequal. The researchers did state they excluded anyone who had had attempted another therapy treatment within 4 weeks to allow a "wash out" period to make sure it was with their treatment they saw results.

➢ **Compensatory rivalry** ➢ **Statistical Regression**	

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
49. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	Subjects were randomly assigned to the groups using a computer program.
50. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	Baseline statistics showed there was no significant difference between groups at the start of the study.
51. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Subjects did not know which group they were in as the cryoultrasound and cryotherapy group used the same equipment and subjects could not recognize the treatment they were receiving.
52. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	The investigator did not know prior to the allocation to which group the subjects were assigned.
53. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	The groups were managed equally with 10 daily treatments lasting for 20 minutes and the only difference being the experimental treatment.
54. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research?	The follow-up time was sufficiently long, done at 3, 12, and 18 months following treatment.

a. If not, what are the potential consequences of this knowledge for the study's results?	
55. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	4 subjects were lost overall. The authors used intention to treat analysis for the missing data not collected during their follow-up appointments. With the intention to treat being used, the end statistics could be slightly skewed based on where the patients were during their last follow-up
56. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	Patients were analyzed into the groups to which they were allocated and for those who dropped out there was intention to treat analysis completed.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***
57. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **58. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	Both treatments were found effective. The difference between cryoultrasound and cryotherapy at 3,12, and 18 months all had significant differences of the scores on the visual analog scale ($p < 0.001$) in favor of the cryoultrasound (3.00, 4.35, and 4.81 respectively) though. For cryotherapy, there was only a significant difference in VAS at 3 months following treatment This means in all time frames following treatment, cryoultrasound is a significantly better option than cryotherapy in the treatment of plantar fasciitis with heel spurs

59. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	29 patients per group to detect the difference of 2.5 in the VAS score which the findings did exceed
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
60. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	The intervention does sound appropriate for use in clinic as long as the cryoultrasound machine is present
61. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	The characteristics are not too similar to the patient. This study had older subjects (54.5) and the inclusion criteria stated they had x-ray confirmed heel spurs and had symptoms for at least 6 months. Despite these differences, as pain was decreased in both groups, it could be reasonable to try this for the patient.
62. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	The researchers stated there were no side effects or complications noted from the study making the risks very minimal and the benefits outweigh those.
63. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	The intervention does fit within the patient's values as it is easily done (10x, 20 min) and saw reductions in pain
64. Are there any threats to external validity in this study?	Yes, a control was not done with no treatment to see the natural progression of the pain symptoms and the baseline characteristics did not match that of the patient/athlete

Reference #5:

Rompe, J. D., Decking, J., Schoellner, C., & Nafe, B. (2003). Shock wave application for chronic plantar fasciitis in running athletes. *The American journal of sports medicine*, *31*(2), 268-275.

Oxford Score: 2b PEDro Score: 7/10

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	The purpose was stated clearly as researchers were looking at the effect of low-energy electromagnetic application of extracorporeal shock wave for pain relief in plantar fasciitis in runners.
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	Background was presented in other possible treatment options for plantar fasciitis that have been looked at in the literature. The researchers also discussed how some limitations in previous studies' design have come to light in the research looking at shock wave application for treatment, which is why they have done this study.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry**	Assignment into the groups was done using sealed envelopes which could have caused potential differences between the groups. Could not have/seek any other treatment until 6 weeks after the shock wave treatment could cause differences between groups as some could seek out alternate help while others did not. Compensatory rivalry was taken out of the equation as the researchers used the sham treatment technique and used a sound reflecting pad to absorb the shock waves from the head during their treatment.

➢ **Statistical Regression**	

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
65. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	Subjects were randomly assigned into either the experimental group (active treatment) or the control group (sham treatment) through use of sealed envelopes.
66. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	The researchers reported the groups were similar in demographics at the start of the trial and had similar weekly mileage, age, sex, duration of pain, weight, or BMI.
67. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	The subjects did not know to which group they were assigned as they received either the active or the sham treatment with the shock wave head.
68. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Investigators did not know who was being assigned to which group prior to allocation and the assessor was blind as to what treatment the patient was in
69. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Groups were managed equally aside from the experimental differences between the group. Up to 6 weeks post shock wave treatment where potential differences could lead to outside variables coming into the management of the plantar fasciitis.
70. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this**	The follow up was done at 6 and 12 months following the final shock wave treatment. Which was adequate in the long term effects of the plantar fasciitis but does not show the short term effects.

knowledge for the study's results?	
71. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	Throughout the whole treatment time, the study lost 6 patients in the active treatment group and 4 in the sham treatment group due to intervention being ineffective and others refusing further contact/could not be contacted. The results were not included in the computation of the data which could lead to false results/significance being seen as their data points were not included.
72. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	The participants were analyzed in the groups to which they were randomized. For those who were lost, the data was excluded meaning false positives for the benefits of the treatment could be seen.
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***
73. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **74. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	The mean difference between groups for pain on first walking in the morning decreased significantly ($p = 0.0004$) between groups (2.6 difference between active and sham treatment) at 6 months. At 1 year, the difference between groups was 2.9 and $p < 0.0001$. For the Ankle-Hindfoot scale there was an increase in score for both groups with increase of 37.2 ± 15.2 in the active treatment and 19.4 ± 17.8 in the sham group ($p = 0.0025$) and the significance between groups continued up to 1 year ($p = 0.0211$). This means the active shock wave treatment proves beneficial in reducing pain over the placebo treatment for runners experiencing plantar fasciitis.

75. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	Researchers set a 3 point change on the visual analog scale as significantly different, for which the findings exceeded.
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
76. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	The intervention does sound appropriate as it did work to reduce pain, but the researchers stated the therapy was considered unpleasant by all participants and it would need and shock wave device/machine
77. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	The subjects are similar in they are both runners. They differ in that they were only running on average 30 miles a week, had the pain for over 12 months, and had failed other treatment options previously. This intervention could still be used despite the differences as it did bring about a reduction in pain
78. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	Despite the risk of it being uncomfortable, the benefits of reducing pain in the long run outweigh the short-term discomfort that would be experienced due to the treatment.
79. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	The intervention fits within the patient's values in that it worked to reduce pain, even if it means having to endure slight discomfort to get those results
80. Are there any threats to external validity in this study?	Yes, although stated there was no difference among groups in patients who received concurrent treatment, those who did could have still altered the results and affecting the effectiveness of the shock wave treatment

Reference #6:

Podolsky, R., & Kalichman, L. (2015). Taping for plantar fasciitis. *Journal of back and musculoskeletal rehabilitation, 28*(1), 1-6.

Oxford Score: 2a PEDro Score: N/A

Does the design follow the Cochrane method?	
Appraisal Criterion	***Reader's Comments***
Step 1 – formulating the question • **Do the authors identify the focus of the review** • **A clearly defined question should specify the types of:** • **People (participants),** • **Interventions or exposures,** • **Outcomes that are of interest** • **Studies that are relevant to answering the question**	The goal of this SR was to investigate the efficacy of different taping techniques in relieving symptoms and dysfunction caused by plantar fasciitis
Step 2 – Locating studies • **Should identify ALL relevant literature** • **Did they include multiple databases?** • **Was the search strategy defined and include:** • **Bibliographic databases used as well as hand searching** • **Terms (key words and index terms)** • **Citation searching: reference lists** • **Contact with "experts" to identify "grey" literature (body of materials that cannot be found easily through conventional channels such as publishers)** • **Sources for "grey literature"**	Multiple databases were included in the search and included PubMed, CINAHL, PEDro, ISI Web of Science, and Google Scholar. Terms were from a list of predetermined items and included "taping", "adhesive tape", "plantar fasciitis", "Plantar fasciosis", "heel spur", "heel pain", and "calcaneal" with the title and abstracts being reviewed for relevance. The search was to include any type of taping method used in the treatment of plantar fasciitis with at least one pain or functional outcome and studies of any methodological quality included with an emphasis on randomized control trials. No searches for "grey literature" were performed.
Part 3: Critical Appraisal/Criteria for Inclusion • **Were criteria for selection specified?** • **Did more than one author assess the relevance of each report** • **Were decisions concerning relevance described; completed by non-experts, or both?**	The criteria for selection were very broad as it could include any taping method used for treatment with one outcome measure looking at pain or function. The review also included studies of any methodological quality, with an emphasis on randomized control trials. The review did not state if more than one author assessed the relevance of each report but did

• **Did the people assessing the relevance of studies know the names of the authors, institutions, journal of publication and results when they apply the inclusion criteria? Or is it blind?**	state the PEDro score was calculated by one author. The decisions appeared to be based on titles and abstracts of the articles, and it would also appear the assessors were not blind.
Part 3 – Critically appraise for bias: • **Selection –** • **Were the groups in the study selected differently?** • **Random? Concealed?** • **Performance –** • **Did the groups in the study receive different treatment?** • **Was there blinding?** • **Attrition –** • **Were the groups similar at the end of the study?** • **Account for drop outs?** • **Detection –** • **Did the study selectively report the results?** • **Is there missing data?**	The review did not mention if studies were critically appraised for bias.
Part 4—collection of the data • **Was a collection data form used and is it included?** • **Are the studies coded and is the data coding easy to follow?** • **Were the studies identified that were excluded & did they give reasons why (i.e., which criteria they failed)**	A collection data form was used in the form of a table showing the basic characteristics of the study with the treatment each group was receiving and the outcome from each. The studies shown are easy to follow from table to table, but they did not include the studies identified and excluded from the current review.

Are the valid results of this SR important	
Appraisal Criterion	***Reader's Comments***
81. Is this a SR of randomized trials? Did they limit this to high quality studies at the top of the hierarchies **a. If not, what types of studies were included?** **b. What are the potential consequences of including**	This is a SR of five randomized trials. They also included two cross-over studies, and one repeated measures study. The studies were not limited to high quality studies and the potential consequence of including these is that due to the lower quality there could have been other variables which caused the differences aside from the tape alone.

these studies for this review's results?	
82. Did this study follow the Cochrane methods selection process and did it identify all relevant trials? **a. If not, what are the consequences for this review's results?**	There was an attempt to include all relevant studies looking at taping as a form of treatment for plantar fasciitis.
83. Do the methods describe the process and tools used to assess the quality of individual studies? **a. If not, what are the consequences for this review's results?**	The methods describe the process of having one author calculate the PEDro score for the studies to assess the quality of the studies.
84. What was the quality of the individual studies included? Were the results consistent from study to study? Did the investigators provide details about the research validity or quality of the studies included in review?	The author's stated the quality of the individual studies included each from high (2 studies), moderate (2), and low (4). Despite this, results were consistent in that the taping provided short term improvements in pain.
85. Did the investigators address publication bias	The researchers stated there may have been publication bias as they found no studies showing negative results.
Are the valid results of this SR important?	
Appraisal Criterion	***Reader's Comments***
86. Were the results homogenous from study to study? **a. If not, what are the consequences for this review's results?**	The results were homogenous from study to study with improvements in pain being seen
87. If the paper is a meta-analysis id they report the statistical results? Did they include a forest plat? What other statistics do they include? Are there Cis?	The paper was not a meta-analysis
88. From the findings, is it apparent what the cumulative weight of the evidence is?	The cumulative weight from the evidence suggests taping can be good treatment technique in the short term, but more research is needed to see the long term effects.
Can you apply this valid, important evidence from this SR in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***

89. Is your patient different from those in this SR?	The patient appears to be different as the only indicator of the demographics of the participants in the study is age (which ranged from 34 to 52)
90. Is the treatment feasible in your setting? Do you have the facilities, skill set, time, 3rd party coverage to provide this treatment?	The treatment is feasible for the setting as taping is an easy, cost effective, treatment option.
91. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	The intervention fits within the patient's stated values and expectations as the taping helped quickly reduce the pain.

What is the bottom line?	
Appraisal Criterion	***Reader's Comments***
Summarize your findings and relate this back to clinical significance	Taping is an effective treatment option for the treatment of plantar fasciitis. Various methods were looked at in this SR, but each showed positive results in the reduction of pain in the short term. This means future research should look at comparing the different taping techniques and include more long term follow-up

Reference #7:

Roos, E., Engström, M., & Söderberg, B. (2006). Foot orthoses for the treatment of plantar fasciitis. *Foot & ankle international*, *27*(8), 606-611.

Oxford Score: 2b PEDro Score: 6 /10

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	Purpose stated clearly which is to look at the effects of custom-fitted orthoses and an anterior night splint as treatment for plantar fasciitis
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	Limited background information at the time of publication for the treatment of plantar fasciitis. The authors did give brief synthesis as to possible reasons orthoses could work and discussed how their article would help fill that gap in knowledge in the treatment of the injury using mechanical modifiers.

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments** ➢ **Compensatory rivalry** ➢ **Statistical Regression**	Prospective, RCT, with 3 treatment groups Randomly assigned by PT not involved with study and questionnaire mailed to coordinator not involved in study 43 patients identified to meet inclusion criteria, based off of referrals from doctors had 79% of data available at 6,12, and 26 weeks and 88% at 52 weeks, used intention to treat analysis for drop-outs and possible cross-over of treatments the participants tried Power analysis showed would need 60 patients to show clinical significance difference

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
92. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	Subjects randomly assigned to treatment groups but in paper although it states no significant difference in pain among the patients at any point in time, it was not mentioned if other statistical analysis was done to see the similarities between groups
93. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	Only general demographics of the participants were reported and not once they were assigned to the treatment group
94. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Subjects did know to which group they were assigned, with potential consequences being they could change their wearing pattern of the device and effect the results
95. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Investigators did not know who was being assigned to which group as PT not involved in the intervention pulled envelopes with the allocation assigned and the questionnaire was mailed to the coordinator not involved with the trial
96. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Groups had somewhat different management due to the nature of the device being tested. One group had only the orthoses which was asked to be worn at least 5 days a week. The night splint group was asked to wear it 7 nights a week. The last group was a combination of the two so with the more time being worn, could have skewed the results
97. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this**	Follow up time was sufficient as they looked at various intervals throughout a year starting at 6 weeks, then going to 12, 26, and finally 52 weeks, short term effects could have been looked at to see if there was any benefit

knowledge for the study's results?	
98. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	Data was not available for all subjects at each of the predetermined time intervals for the testing Of the initial 43, 34 were available at 6,12, and 26 weeks, while 38 were available at 52 Due to this, the authors stated they completed an intention to treat analysis
99. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	It would appear the participants were analyzed in the groups to which they were randomized and the intention to treat analysis was done to help deal with possible noncompliance and cross-over between treatment
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***
100. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI** **101. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?**	Although the results showed promise in levels of pain were decreased across all treatment groups, a control group was not utilized to see if with time, there would not have been a decrease in pain as well. All groups improved significantly in all five subscales (pain, symptoms, activities of daily living, sport and recreation function, and quality of life) $p < 0.04$, there was no significant difference in pain among the three groups at any point in time ($p = 0.12$ to 0.89), when only comparing either of the groups treated with orthotics to the night splint group there was significantly higher pain reduction (62% vs 48%) $p < 0.01$ Data showed significant improvements across the board, but not sure if time would have seen similar results

102. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	Researchers set $p<0.05$, and power analysis stated they would need a change of 10 points in the Foot and ankle outcome score to detect change. Although the number of participants did not meet the power analysis of 60, there was greater than 10 point changes seen showing the benefits of the treatment
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
103. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	Foot orthoses and night splints are appropriate for use and relatively affordable for the treatment of plantar fasciitis
104. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	The study subjects were slightly different than the client as a majority were female (79%) and average age was 46. Despite this, it was reported many of the participants were active in sports so it could make the results applicable to the patient
105. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	The potential benefits of improving in all five areas of the foot and ankle outcome score greatly outweigh the slight side effects seen the first few weeks of wearing the new device
106. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	Yes, the intervention fits within the patient's values and expectations
107. Are there any threats to external validity in this study?	Yes, the smaller sample size and based of convenience could impact the external validity as well as the participants' difference from the patient

Reference #8:

Ryan, M., Fraser, S., McDonald, K., & Taunton, J. (2009). Examining the degree of pain reduction using a multielement exercise model with a conventional training shoe versus an ultraflexible training shoe for treating plantar fasciitis. *The Physician and sportsmedicine, 37*(4), 68-74.

Oxford Score: 3b PEDro Score: 4 /10

Is the purpose and background information sufficient?	
Appraisal Criterion	***Reader's Comments***
Study Purpose Stated clearly? Usually stated briefly in abstract and in greater detail in introduction. May be phrased as a question or hypothesis. A clear statement helps you determine if topic is important, relevant and of interest to you. Consider how the study can be applied to PT and/or your own situation. What is the purpose of this study?	Purpose stated clearly as authors are looking to see if a multielement exercise model can improve pain levels in individuals with plantar fasciitis and whether if doing those exercises in an ultraflexible midsole will have a greater effect than those wearing conventional shoes
Literature Relevant background presented? A review of the literature should provide background for the study by synthesizing relevant information such as previous research and gaps in current knowledge, along with the clinical importance of the topic. Describe the justification of the need for this study	Relevant background provided, looking at what has been shown to work (PT, orthoses, and steroid injection) as well as limitations in those such as risk for rupture with the injection. This study was done to see if along with PT exercises if the shoe being worn made a difference in pain levels

Does the research design have internal validity?	
Appraisal Criterion	***Reader's Comments***
➢ **Discuss possible threats to internal validity in the research design. Include:** ➢ **Assignment** ➢ **Attrition** ➢ **History** ➢ **Instrumentation** ➢ **Maturation** ➢ **Testing** ➢ **Compensatory Equalization of treatments**	Participants were recruited from advertisements, which could lead to respondents not representing the whole of the population, assignment done via number generator could lead to unequal groups, the groups were based on wearing an ultraflexible shoe (limited to the Nike Free) whereas the conventional group could wear their typical shoe as long as it was confirmed to be classified as neutral-supportive or stability

➢ **Compensatory rivalry** ➢ **Statistical Regression**	

Are the results of this therapeutic trial valid?	
Appraisal Criterion	***Reader's Comments***
108. Did the investigators randomly assign subjects to treatment groups? **a. If no, describe what was done** **b. What are the potential consequences of this assignment process for the study's results?**	Subjects were randomly assigned using a numbers generator
109. Were the groups similar at the start of the trial? Did they report the demographics of the study groups? **a. If they were not similar – what differences existed?**	Groups were similar at the start of the trial in baseline characteristics except for symptom duration as the authors reported two of the subjects in the Free group had disproportionately greater symptom durations at 123 and 108 months)
110. Did the subjects know to which treatment group they were assign? **a. If yes, what are the potential consequences of the subjects' knowledge for this study's results**	Subjects knew to which group they were assigned as it is evident to tell which shoe is being worn and one group receiving new footwear, which could affect the amount of effort being put forth by the participants
111. Did the investigators know who was being assigned to which group prior to the allocation? **a. If they were not blind, what are the potential consequences of this knowledge for the study's results?**	Investigators did not know who was being assigned to which group prior to allocation as it was done by a computer generator following a baseline interview
112. Were the groups managed equally, apart from the actual experimental treatment? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Groups were managed equally as they were instructed to do the same exercises and the same number of reps, with the only thing different as the shoes being worn

113. Was the subject follow-up time sufficiently long to answer the question(s) posed by the research? **a. If not, what are the potential consequences of this knowledge for the study's results?**	Follow-up was done at pretest, at the mid and post point of the treatment (12 week duration) and then at 6 months, although initially the follow-up was sufficient, it is hard to form conclusions for long term effects based only on data collected from 6 months
114. Did all the subjects originally enrolled complete the study? **a. If not how many subjects were lost?** **b. What, if anything, did the authors do about this attrition?** **c. What are the implications of the attrition and the way it was handled with respect to the study's findings?**	3 out of the 24 subjects dropped out (all were in the Free group) of which 2 had experienced an increase in foot pain, the authors did intention to treat analysis was not done but the dropouts were done before any follow-ups were done which could show the shoes may not be as beneficial as it is first made out to be
115. Were all patients analyzed in the groups to which they were randomized (i.e. was there an intention to treat analysis)? **a. If not, what did the authors do with the data from these subjects?** **b. If the data were excluded, what are the potential consequences for this study's results?**	Patients were analyzed based on the group to which they were assigned, it was reported with the data from the subjects who dropped out an intention to treat analysis was not done which could further alter the results and change the effect the shoe has on pain level
Are the valid results of this RCT important?	
Appraisal Criterion	***Reader's Comments***
116. What were the statistical findings of this study? **a. When appropriate use the calculation forms below to determine these values** **b. Include: tests of differences? With p-values and CI** **c. Include effect size with p-values and CI** **d. Include ARR/ABI and RRR/RBI with p-values and CI** **e. Include NNT and CI**	Significant improvements seen in pain for both groups by the 6-month follow-up. No difference in footwear groups but there was a trend suggestive of a difference at the midpoint and posttest for the Free group As the researchers pointed out, it is hard to interpret if the benefits seen were due to the shoes being worn or if it was the exercises which caused the benefits. In regard to practice, it would seem the exercise proves more beneficial with the shoe being worn only causing a minute effect

117. What is the meaning of these statistical findings for your patient/client's case? What does this mean to your practice?	
118. Do these findings exceed a minimally important difference? **a. If not, will you still use this evidence?**	Minimally important difference not established in the article
Can you apply this valid, important evidence about an intervention in caring for your patient/client? What is the external validity?	
Appraisal Criterion	***Reader's Comments***
119. Does this intervention sound appropriate for use (available, affordable) in your clinical setting?	This intervention would be appropriate in the setting in that the exercises could easily be performed and the possibility of a new shoe recommendation could easily be made
120. Are the study subjects similar to your patient/ client? **a. If not, how different? Can you use this intervention in spite of the differences?**	The study subjects were different than the patient in that they were older (average age around 40) and BMI was higher (around 30), despite these differences this intervention could still be tried as the intended outcome was the same in pain relief
121. Do the potential benefits outweigh the potential risks using this intervention with your patient/client?	Although there was an increase in pain in two subjects who dropped out who wore the Frees, the exercises did seem to help so the benefits of decreasing pain outweigh the risks
122. Does the intervention fit within your patient/client's stated values or expectations? **a. If not, what will you do now?**	Exercises as well as possibly trying new shoes does fit within the patient's values and expectations
123. Are there any threats to external validity in this study?	Yes, two of the researchers disclosed conflicts of interest with Nike (the maker of the shoes)

Appendix B—Articles Analyzed Summary:

Article	Oxford Level of Evidence	PEDro Score	Purpose	Outcome Measures	Results	Did it answer PICO?
Celik et al (2016)	2b	7/10	To compare the effectiveness of joint mobilization combined with stretching exercises versus steroid injection in the treatment of plantar fasciitis	Visual Analog Scale—pain Foot and Ankle Ability Measure—functional score	significant improvements were seen in pain relief and functional outcomes ($p < .05$) at the 3,6, and 12 week follow ups compared to baseline. Improvements at the 12 week and 1 year were only better in the joint mobilization and stretching group. Between group differences favored the steroid group at the 3 ($p = .001$ and .001), 6 ($p = .002$ and .001), and 12 week ($p = .008$ and .001) for both pain and functional outcomes but there was no difference seen at the one year follow up ($p = .62$ and .57)	Yes
Kamonseki et al (2015)	2b	8/10	To compare the effect of stretching with and without muscle strengthening of the foot alone or the foot and hip on pain and function in patients with plantar fasciitis	Visual Analog Scale—pain Foot and Ankle Outcome Score—function Star Excursion Balance Test—lower limb stability and balance	Significant improvements were seen in all groups for the VAS pre and post as well as the pain, activities of daily living, sports and recreation, quality of life ($p < 0.001$) and other symptoms ($p < 0.01$) subscales of the Foot and Ankle Outcome Score. Posterior medial and posterolateral movements, and composite score on the Star Excursion Balance Test increased ($p < 0.001$), but no difference was seen in the anterior movement ($p = 0.17$). The were no	Yes

					time-group interactions or difference between groups over time ($p > 0.05$)	
Rathleff et al (2015)	2b	6/10	To investigate the effectiveness of shoe inserts and plantar fascia-specific stretching versus shoe inserts and high-load strength training in patients with plantar fasciitis	Foot Function Index (three subscales—pain, disability, and activity limitation) Thickness of the plantar fascia, foot pain at worst, foot pain at first step in morning, satisfaction with results, physical activity level, and average leisure time sports participation	At 3 months, the high load strength group had a FFI significantly better than the stretch group ($p = 0.016$) (29 point difference), At 1, 6, and 12 there was a nonsignificant difference ($p > 0.34$) (5-7 point) between groups. For secondary outcomes, the strength group reported significantly less worse foot pain at 3 months, and were more satisfied at 3 and 12 months. There were no other significant differences between groups	Yes
Costantino et al (2014)	1b	8/10	To evaluate the efficacy of cryoultrasound compared to cryotherapy in patients with chronic plantar fasciitis with heel spurs	Visual analog scale—for pain	Both treatments were found effective. The difference between cryoultrasound and cryotherapy at 3,12, and 18 months all had significant differences of the scores on the visual analog scale ($p < 0.001$) in favor of the cryoultrasound (3.00, 4.35, and 4.81 respectively) though. For cryotherapy, there was only a significant difference in VAS at 3 months following treatment	Yes

Rompe et al (2003)	2b	7/10	To look at the effect of low-energy electromagnetic application of extracorporeal shock wave for pain relief in runners with plantar fasciitis	Visual analog scale—pain on first step American Orthopedic Foot and Ankle Society's Ankle-Hindfoot Scale—pain and function	The mean difference between groups for pain on first walking in the morning decreased significantly ($p = 0.0004$) between groups (2.6 difference between active and sham treatment) at 6 months. At 1 year, the difference between groups was 2.9 and $p < 0.0001$. For the Ankle-Hindfoot scale there was an increase in score for both groups with increase of 37.2 ± 15.2 in the active treatment and 19.4 ± 17.8 in the sham group ($p = 0.0025$) and the significance between groups continued up to 1 year ($p = 0.0211$).	Yes
Podolsky & Kalichman (2015)	2a	N/A	Systematic review looking to investigate the efficacy of different taping techniques in relieving symptoms and dysfunction caused by plantar fasciitis	Systematic review	Of the eight studies included, all showed significant improvement in pain among those receiving the different taping techniques in the short term.	Yes

Roos et al (2006)	2b	6/10	To study the effects of custom-fitted orthoses and an anterior night splint for treatment of plantar fasciitis	Foot and Ankle Outcome Score—with pain primary outcome Sporting Activities—5 point scale	Orthoses, night splint, and orthoses+night splint were significantly better in all five subscales (pain, symptoms, activities of daily living, sport and recreation function, and quality of life) $p < 0.04$ there was no significant difference in pain among the three groups at any point in time ($p = 0.12$ to 0.89).	Yes
Ryan et al (2009)	3b	4/10	To see if a multielement exercise model incorporating static and dynamic stretching and balance exercises can improve pain levels in individuals with plantar fasciitis and whether if doing those exercises in an ultraflexible midsole will have a greater effect than those wearing conventional shoes	Visual analog scale—pain assessment	Significant improvements seen in pain for both groups by the 6-month follow-up. No difference in footwear groups but there was a trend suggestive of a difference at the midpoint and posttest for the Free group	Yes

References:

Aschwanden, C. (2017). The big 7 body breakdowns. Retrieved from https://www.runnersworld.com/health/the-big-7-body-breakdowns on January 6, 2017.

Celik, D., Kuş, G., & Sırma, S. Ö. (2016). Joint mobilization and stretching exercise vs steroid injection in the treatment of plantar fasciitis: a randomized controlled study. *Foot & ankle international*, *37*(2), 150-156.

Christensen, S. (2017). Common injuries in distance runners. Retrieved from https://www.completetrackandfield.com/common-injuries-distance-runners/ on January 6, 2017.

Costantino, C., Vulpiani, M. C., Romiti, D., Vetrano, M., & Saraceni, V. M. (2014). Cryoultrasound therapy in the treatment of chronic plantar fasciitis with heel spurs. A randomized controlled clinical study. *European journal of physical and rehabilitation medicine*, *50*(1), 39-47.

Dias Lopes, A., Hespanhol Junior, L. C., Yeung, S. S., & Pena Costa, L. O. (2012). What are the Main Running-Related Musculoskeletal Injuries?. Sports Medicine, 42(10), 891-905.

Drake, R. L., Mitchell, A. W., & Vogl, W. (2010). *Grays anatomy for students* (2nd ed.). Philadelphia, PA: Churchill Livingstone.

Huffer, D., Hing, W., Newton, R., & Clair, M. (2017). Strength training for plantar fasciitis and the intrinsic foot musculature: A systematic review. *Physical Therapy in Sport*, *24*, 44-52.

Kamonseki, D. H., Gonçalves, G. A., Liu, C. Y., & Júnior, I. L. (2016). Effect of stretching with and without muscle strengthening exercises for the foot and hip in patients with plantar fasciitis: a randomized controlled single-blind clinical trial. *Manual therapy*, *23*, 76-82.

Levangie, P. K., & Norkin, C. C. (2015). Joint structure and function: a comprehensive analysis (5th ed.). Philadelphia, PA: F.A. Davis Company.

Long Distance Running – State of the Sport. (n.d.). Retrieved from http://www.usatf.org/news/specialReports/2003LDRStateOfTheSport.asp on January 6, 2017.

Magee, D. J. (2008). *Orthopedic physical assessment* (5th ed.). St. Louis: Saunders.

Podolsky, R., & Kalichman, L. (2015). Taping for plantar fasciitis. *Journal of back and musculoskeletal rehabilitation*, *28*(1), 1-6.

Rathleff, M. S., Mølgaard, C. M., Fredberg, U., Kaalund, S., Andersen, K. B., Jensen, T. T., Aaskov, S., & Olesen, J. L. (2015). High-load strength training improves outcome in patients with plantar fasciitis: A randomized controlled trial with 12-month follow-up. *Scandinavian journal of medicine & science in sports*, *25*(3), 1-9.

Ribeiro, A. P., João, S. M. A., Dinato, R. C., Tessutti, V. D., & Sacco, I. C. N. (2015). Dynamic Patterns of Forces and Loading Rate in Runners with Unilateral Plantar Fasciitis: A Cross-Sectional Study. *PLoS ONE*, *10*(9), 1-9.

Rompe, J. D., Decking, J., Schoellner, C., & Nafe, B. (2003). Shock wave application for chronic plantar fasciitis in running athletes. *The American journal of sports medicine*, *31*(2), 268-275.

Roos, E., Engström, M., & Söderberg, B. (2006). Foot orthoses for the treatment of plantar fasciitis. *Foot & ankle international*, *27*(8), 606-611.

Running USA – U.S. Road Race Trends. (2017). Retrieved from http://www.runningusa.org/2017-us-road-race-trends on January 6, 2017.

Ryan, M., Fraser, S., McDonald, K., & Taunton, J. (2009). Examining the degree of pain reduction using a multielement exercise model with a conventional training shoe versus an ultraflexible training shoe for treating plantar fasciitis. *The Physician and sportsmedicine*, *37*(4), 68-74.

Thiagarajah, A. G. (2017). How effective is acupuncture for reducing pain due to plantar fasciitis? *Singapore medical journal*, *58*(2), 92-97.

Videbæk, S., Bueno, A. M., Nielsen, R. O., & Rasmussen, S. (2015). Incidence of running-related injuries per 1000 h of running in different types of runners: a systematic review and meta-analysis. *Sports medicine*, *45*(7), 1017-1026.