2-12-2016

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## Background

- Plantar fasciitis occurs in more than 2M Americans each year and is the most common cause of acute heel pain[1,2].
- Night splints are one conservative intervention that is available to patients affected by plantar fasciitis, but there is limited evidence on their effectiveness.
- To our knowledge, this is the first review to evaluate the efficacy of night splints.




## Objective

To investigate the use of night splints for the treatment of plantar fasciitis and the current evidence regarding their ability to affect symptoms associated with plantar fasciitis.

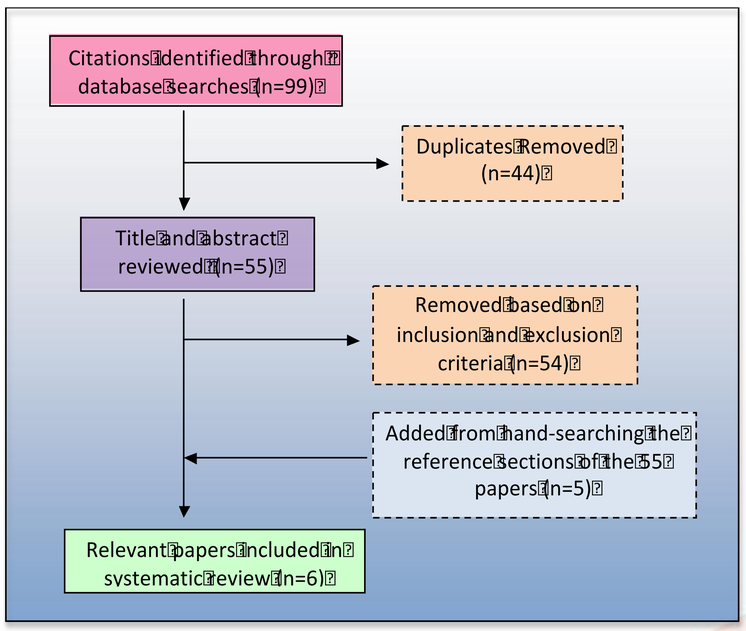
## Methods

Article selection process:

Databases: CINAHL, PubMED, Cochrane, PEDro, Scopus, Sports Discuss, and Ovid-Medline

Search Terms: plantar fasciitis, physical therapy, night splints. All three search terms were combined with 'AND'.

Evaluation: The GRADE approach was used to evaluate the quality of each paper[3].




**Flow diagram for article identification, review, and selection**

## Results

Six papers that met the established inclusion and exclusion criteria were included in this systematic review. Four papers were observational and two papers were randomized controlled trials. The evidence ranged from high to very low quality. The recommendation for use of night splints was weak in all six papers.

Patient characteristics and interventions used to treat plantar fasciitis

| Authors, Year | Number of Subjects (M/F) | Age Range | Mean Age (± SD) | Interventions | Length of interventions | Outcome measurements |
|---|---|---|---|---|---|---|
| Lee et al; 2012 | 28 (2/26) | 30-54 | Group A: 43 (5) Group B: 45 (8) | Group A: Accomodative foot orthosis. Group B: Accomodative foot orthosis and adjustable dorsiflexion sock-type night splint at 20° MTP extension and 5° ankle dorsiflexion | 8 weeks | Foot Function Index (FFI) questionnaire |
| Logan et al; 2006 | 1 (0/1) | - | 18 | Autologous blood injections, botulinum toxin injections, adjustable dorsiflexion posterior night splint in neutral ankle inversion and eversion position | unknown | Visual analog scale (VAS), Modified Ashworth Scale, Observational Gait Scale |
| Attard et al; 2012 | 15 (11/4) | 26-68 | 51 | Group A: Anterior night splint (foot and ankle in plantigrade position) Group B: Posterior night splint | 12 weeks | Numerical pain rating scale (0= no pain, 10 = most severe pain) |
| Roos et al; 2006 | 43 (9/34) | 22-63 | 46 | Group A: Custom-fitted orthoses (neutral alignment) Group B: Foot orthoses and anterior night splint, foot at 90° of dorsiflexion (neutral plantigrade) Group C: Anterior night splint, foot at 90° of dorsiflexion (neutral plantigrade) | 52 weeks | Foot and Ankle Outcome Score (FAOS), daily logs for compliance |
| Sheridan et al; 2010 | 60 (14/46) | unknown | 49.5 (18.2) | Group A: Standard are (NSAIDs, orthoses, and corticosteroid injections) Group B: Standard care, ankle dorsiflexion Dynasplint (initial tension of 2.0 ft-lb of torque) | 12 weeks | Plantar Fasciopathy Pain/Disability Scale |
| Beyzadeoglu et a; 2010 | 44 (18/26) | 22-44 | 33.1 (7.7) | Group A: Silicone heel cushion for shoe, silicone heel cushion for slippers, oral NSAID's, activity modification, stretching exercise, diet for overweight patients (BMI>25) Group B: Same has group A plus posterior night splint at 5 ° of dorsiflexion | 33.2 months | Ankle-Hindfoot Rating Scale (AHRS) and Visual analog scale (VAS) |

GRADE evidence profile: the effect of night splints in the treatment of plantar fasciitis

| Quality Assessment | | | | | | | | | Summary of Findings | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | B | C | D | E | F | G | H | I | J | K | L |
| Lee *et al.* : Effectiveness of adjustable dorsiflexion night splints in combination with accommodative foot orthosis on plantar fascia | | | | | | | | | | | |
| 1 | O | Yes (-1)[a,b] | No | No | No | No (U) | 28 | 0 | At both 2 and 8 weeks both pain (p=0.01) and total FFI (p=0.01) had significantly lower scores than at baseline in subjects who received accomodative foot orthoses and dorsiflexion night splints. There were no significant changes in the subjects receiving only foot orthoses. | VL | (+) |
| Logan *et al.*: Autologous blood injection and botulinum toxin for resistant plantar fasciitis accompanied by spasticity | | | | | | | | | | | |
| 1 | O | Yes (-1)[c,d,e] | No | No | No | No (U) | 1 | 0 | Ankle and foot were maintained in comfortable range during sleep. Authors suggested night splints were effective in maintaining tissue flexibility. | VL | (+) |
| Attard & Singh: A comparison of two night ankle-foot orthoses used in the treatment of inferior heel pain: A preliminary investigation | | | | | | | | | | | |
| 1 | O | Yes (-1)[b,f] | No | No | No | No (U) | 15 | 0 | 67% of patients who wore AFOs had a decrease in pain. Anterior AFOs placed in a plantigrade position reduce plantar flexion pain more than posterior AFOs placed in a dorsiflexion stretch (p=0.0023). | VL | (+) |
| Roos *et al.*: Foot Orthoses for the Treatment of Plantar Fasciitis | | | | | | | | | | | |
| 1 | RT | No | No | No | No | No (U) | 43 | 0 | Orthotic, anterior night splint, & combined groups all improved in all 5 subscales of the FAOS* (p<0.04). | H | (+) |
| Sheridan *et al.*:Plantar Fasciopathy Treated with Dynamic Splinting: A Randomized Controlled Trial | | | | | | | | | | | |
| 1 | RT | No[b] | No | No | No | No (U) | 60 | 0 | At 12 weeks the experimental group average score improved by 48% for the Plantar Fasciopathy Pain/Disability Scale compared to the other group (P<0.0001). | H | (+) |
| Beyzadeoglu *et al.*:The effectiveness of dorsiflexion night splint added to conservative treatment for plantar fasciitis | | | | | | | | | | | |
| 1 | O | No | No | No | No | No (U) | 44 | 0 | Dorsiflexion night splints combined with conservative treatment for 8 weeks improved the AOFAS ankle-hindfoot scale (P=0.01) and visual analog scale (P=0.001). This difference was not sustained on long-term follow-up. | L | (+) |

A. Number of Studies
B. Design - RT: Randomized trial; O: Observational
C. Limitations - No: No serious limitations; Yes: Serious. [a]Variability of heel pain duration. [b]Activity level of subjects not described. [c]Comorbidity of calf spasticity. [d]Main focus was on autologous blood injection. [e]Treatment timeline not well deliniated. [f]Data on comfort, don-doffing, & compliance were discussed w/o data provided.
D. Inconsistency - No: No serious inconsistency; Yes.
E. Indirectness - No: No serious indirectness; Yes.
F. Imprecision - No: No serious imprecision; Yes: Small sample size.
G. Publication bias - U: Undetected.
H. Number of tested patients
I. Number of controls
J. Summary of findings
K. Quality - H: High; M: Moderate; L: Low; VL: Very low.
L. Recommendation - (++): Strong for; (+): Weak for; (-): Weak against.
*Foot and Ankle Outcome Score

## Discussion

The evidence presented in this systematic review included six papers that implemented one of four types of night splints: posterior,[5,6,9] anterior,[6,7] sock-type[4] or Dynasplint[8] (Severna Park, MD). From the available evidence, it is suggested that night splints may be helpful in treating the common symptoms of plantar fasciitis.

- Two papers discussed in this review used posterior-tension splints to maintain ankle dorsiflexion and toe extension.[5, 9]
  - Logan et al.[5] focused on the use of autologous blood injection in a subject with calf spasticity, which prevented a definitive interpretation on the effectiveness of posterior night splints.
  - Beyzadeoglu et al.[9] suggested that the use of posterior night splints has no significant effect on the long-term recurrence of symptoms.
- One paper investigated the use of anterior tension splints.[7]
  - Roos et al.[7] suggested that patient compliance in wearing anterior night splints is better than for posterior splints because the splint does not need to be removed for walking and in general is more comfortable due to better heat dissipation.
- One paper compared the use of anterior and posterior night splints.[6]
  - Attard et al.[6] reported that the use of anterior night splints led to decreased sleep disturbances and was consequently better tolerated by the subjects.
- One paper investigated a sock-type night splint.[4]
  - Lee et al.[4] suggested that the adjustable and soft night splint aids in compliance by decreasing the level of discomfort, however, the activity level of the subjects was not presented and there was significant variability in the duration of heel pain (2-24 months).
- One paper utilized a Dynasplint for the treatment of plantar fasciitis.[8]
  - Sheridan et al.[8] suggested that the dynamic splints have the ability to maintain tension while the connective tissues adaptively elongate, which is a key difference compared to other types of splinting.

## Limitations

- Papers written in English
- Published from June 2005 to June 2015
- Patients were at least 18 years old
- No prior surgical interventions
- Overall low level of evidence
  - Two RCTs
  - Four observational
- Short follow-ups

## Conclusions

The available evidence suggests that night splints may be helpful in treating the common symptoms of plantar fasciitis, with anterior splints being better tolerated than posterior splints.

## Future Research

- More consistent ankle positions
- Most effective ankle positions (neutral plantigrade vs. dorsiflexed)
- Long term effects of splinting
- Longer follow-up studies
- Larger sample sizes
- More RCTs
- Use of functional outcome measures
- Insight into patients' activity levels
- More diverse population in regards to BMI

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