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Research

The Effect of Foot Orthosis Use in Reducing Pain in Patients with Plantar Fasciitis: A Meta-Analysis

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ABSTRACT

Background: Plantar fasciitis is an inflammatory problem that occurs in the foot area that causes pain. Its prevalence rates range from 4% to 7% in the elderly population, 8% in athletes and up to 25% in runners. One of the treatments used to reduce the degree of pain is the use of foot orthosis. A number of related articles stated that the use of foot orthosis can reduce the degree of pain in plantar fasciitis patients. The purpose of this study was to estimate the magnitude of the effect of using foot orthosis on pain reduction in plantar fasciitis patients by conducting a meta-analysis on the same number of articles.
Subjects and Method: The meta-analysis was carried out by systematically reviewing the same number of articles from PubMed, Science Direct, and Google Scholar. By using the search keywords "foot orthosis" OR "FO" AND "custom foot orthosis" AND "foot pain" AND "plantar fasciitis" AND "plantar fasciopathy" AND "effect foot orthosis for plantar fasciitis" AND "treatment for plantar fasciitis" A "randomized controlled trial". The intervention given was the use of a foot orthosis with a comparison without using a foot orthosis with the study subject of plantar fasciitis patients. The study outcome was pain reduction. The article used is a full text article with a randomized controlled trial design that reports the value of the effect size (mean and standard deviations). Articles were collected using the PRISMA flow chart and analyzed using the Review Manager 5.3 application with random effect models.
Results: A meta-analysis of 7 randomized controlled trial studies from Brazil, Virginia, Turkey, Germany, China, and Australia suggested that the use of foot orthosis was -0.54 times better at reducing pain in plantar fasciitis patients compared to those without foot orthosis (ES= -0.54; 95% CI -1.11 to 0.03; p= 0.06). Heterogeneity I^2= 82%.
Conclusion: Foot orthosis reduces pain in plantar fasciitis patients compared to those without foot orthosis

Keywords: Plantar fasciitis, pain, foot orthosis

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BACKGROUND

One of the musculoskeletal problems that often occurs in the foot is plantar fasciitis (Rustanti and Wahyu, 2014). Plantar fasciitis is an inflammatory problem that occurs in the plantar fascia in the foot area. The plantar fascia helps support the arch (arcus) in the foot.

80% of these foot injuries are due to pain that occurs in the plantar area and 8-10% are due to injuries while running. Some of the causes of plantar fasciitis are

obesity, degeneration, overuse, leg abnormalities such as flat foot/pes planus and high arch/pes cavus, sportsmen especially runners, and the tightness in the gastrocnemius or soleus muscles.

Plantar fasciitis can occur at all ages, but usually affects groups of people with an average age of 40-60 years old and can occur in active individuals or individuals who do not do much movement (Okur and Aydin, 2019). But in someone who has an abnormal foot, namely flat foot, it can occur at the age of less than 40 years old (Setyawan, 2016). The results of research conducted by Suzan stated that this plantar fasciitis accounts for 41.5% of problems in musculoskeletal cases in every tertiary care center in California, United States and has more than 600,000 outpatients each year (Goweda, 2015).

Some of the problems experienced by these plantar fasciitis patients are the emergence of pain (both silent pain, tenderness, and pain when moving) (Kuswardani et al., 2018). The pain occurs around the back of the heel. Pain in plantar fasciitis usually appears when waking up in the morning when the patient wants to place his/her foot on the floor for the first time, when standing for a long time, when walking long distances, when sitting too long, and will increase when walking.

Commonly used conservative methods to treat cases of plantar fasciitis include steroid injection, ultrasound therapy, laser therapy, extracorporeal shock wave therapy (ESWT), exercises and stretching therapy using the right footwear, and the use of orthoses (Okur and Aydin, 2019).

In the case of plantar fasciitis, orthotic prosthetics has an important role in improving the health status of the community because health is an important thing for society. In the treatment of plantar fasciitis, orthotic prostheses have a role in providing orthosis services in the form of foot orthosis/insole/footwear modifications/shoe modifications which have the aim of providing support to the plantar area of the foot so that it can reduce pain and can improve static balance in patients (Setyawan, 2016).

Many studies have shown that the use of foot orthoses of various types and designs can have an effect on reducing the degree of pain in plantar fasciitis patients.

One of them is a study conducted by Cozta, 2019 which focuses at the effect of insole on flip-flops in people with plantar fasciopathy showing a reduction in the degree of pain with (MD= –1.82; 95% CI= –3.3 to –0.3; p= 0.016). This study supported the authors to carry out systematic reviews and meta-analyzes involving orthotic treatment with the use of foot orthoses in reducing the pain of plantar fasciitis patients.

SUBJECTS AND METHOD

1. Study Design

This study is a systematic study and meta-analysis. The articles used in this study were obtained from several databases including PubMed, Science Direct, and Google Scholar. The keywords were “foot orthosis” OR “FO” AND “custom foot orthosis” AND “foot pain” AND “plantar fasciitis” AND“plantar fasciopathy” AND “effect foot orthosis for plantar fasciitis” AND “treatment for plantar fasciitis” “randomized controlled trial”.

2. Inclusion Criteria

The articles included in this study were full paper articles with a randomized controlled trial (RCT). The intervention given was the use of a foot orthosis with a comparison without foot orthosis with the research subject being plantar fasciitis patients of all ages. The study outcome was pain reduc-

tion, with the articles of which the study was conducted around the world.

3. Exclusion Criteria

Articles published in this study were articles published in languages other than English and articles published under 2000.

4. Operational Definition of Variables

The article search was carried out by considering the eligibility criteria defined using the PICO model. The population in this study was plantar fasciitis patients at all ages, intervention in the form of use of foot orthosis, comparison, namely not using foot orthosis and outcome in the form of pain reduction.

Pain is an unpleasant sensory and emotional experience due to the damage done to the tissue, either actual or potential or described in the form of damage to the part itself. Instrument: VAS scale with a continue measurement scale.

Foot orthoses (FO) is a type of orthosis that is used to correct, immobilize, compensate, relieve deformities that occur in the foot joint. Instruments: medical records with a categorical measuring scale.

5. Data Analysis

Data processing was carried out by the Review Manager (RevMan 5.3) by calculating the standardized mean difference to determine the research model that was combined and formed the final meta-analysis result.

RESULTS

The process of searching for articles by conducting database searches with PRISMA flow diagrams can be seen in Figure 1.

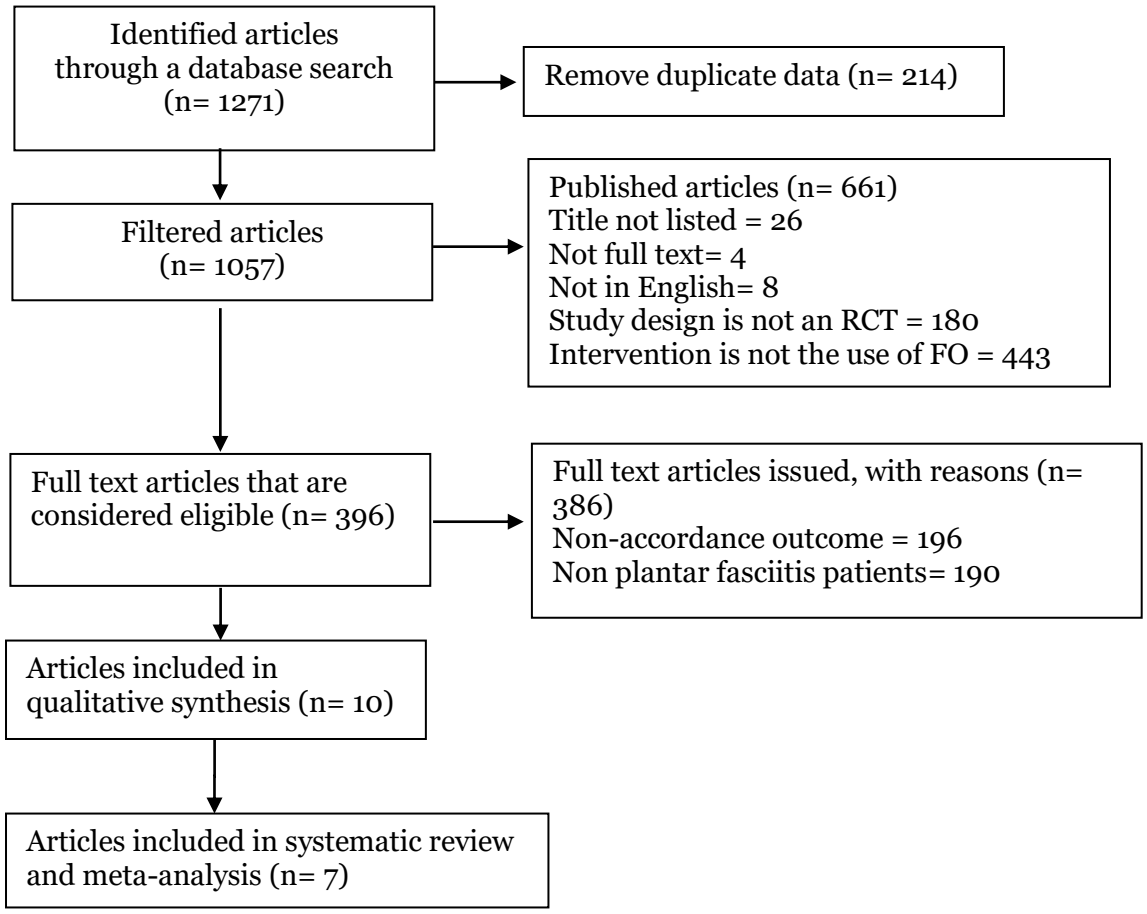

Figure 1. flow chart diagram

Table 1. Assessment of Study Quality

Checklist questions	Costa *et al.*, (2019)			Oliveira *et al.*, (2015)			Lunen *et al.*, (2011)			Yucel *et al.*, (2013)			Walther *et al.*, (2013)			Fong *et al.*, (2012)			Bishop *et al.*, (2018)		
	Yes	Not explained	No	Yes	Not explained	No	Yes	Not explained	No	Yes	Not explained	No	Yes	Not explained	No	Yes	Not explained	No	Yes	Not explained	No
Does this study address a clear research focus?	√			√			√			√			√			√			√		
Is the RCT research method suitable for answering research questions?	√			√			√			√			√			√			√		
Are there enough subjects in the study to establish that the findings were not made by chance?	√			√			√			√			√			√			√		
Are subjects randomly allocated to the experimental and control groups? If not, could this be biased?	√			√			√			√			√			√			√		
Is inclusion/ exclusion criteria are used?	√			√			√			√			√			√			√		
Are the two	√			√			√			√			√			√			√		

Checklist questions	Costa *et al.*, (2019)			Oliveira *et al.*, (2015)			Lunen *et al.*, (2011)			Yucel *et al.*, (2013)			Walther *et al.*, (2013)			Fong *et al.*, (2012)			Bishop *et al.*, (2018)		
	Yes	Not explained	No	Yes	Not explained	No	Yes	Not explained	No	Yes	Not explained	No	Yes	Not explained	No	Yes	Not explained	No	Yes	Not explained	No
groups comparable at study entry?																					
Are objective and unbiased outcome criteria used?	√			√			√			√			√			√			√		
Are objective and validated measurement methods used to measure the results? If not, are the results scored by someone who does not know the group assignment (i.e. is the grading blended)?	√			√			√			√			√			√			√		
Is the effect size practically relevant?	√			√			√			√			√			√			√		
How precise is the estimated effect? Is there a confidence	√			√			√			√			√			√			√		

Checklist questions	Costa *et al.*, (2019)			Oliveira *et al.*, (2015)			Lunen *et al.*, (2011)			Yucel *et al.*, (2013)			Walther *et al.*, (2013)			Fong *et al.*, (2012)			Bishop *et al.*, (2018)		
	Yes	Not explained	No	Yes	Not explained	No	Yes	Not explained	No	Yes	Not explained	No	Yes	Not explained	No	Yes	Not explained	No	Yes	Not explained	No
interval?																					
Could there be confounding factors that have not been taken into account?	√			√			√			√			√			√			√		
Are the results applicable to your study?	√			√			√			√			√			√			√		

√ If the answer is Yes

Table 2. Summary Source Articles

The 7 articles showed that there was an effect of using foot orthosis on reducing the degree of pain in plantar fasciitis patients

Author (Year)	Country	Study Design	Sample	P	I	C	O
Costa et al., (2019)	Brazil	Randomized Controlled Trial	Foot orthosis : 34 Non foot orthosis : 32	Plantar fasciitis patients with an average age in the intervention group were 47.4 years old and in the control group were 47.8 years old.	To examine the effect of using foot orthosis on pain *, foot function, and functional capacity in plantar fasciitis patients.	Not examine the effect of using foot orthosis on pain, foot function, and functional capacity in plantar fasciitis patients.	Reduction in degree of pain
Oliveira et al., (2015)	Brazil	Randomized Controlled Trial	Foot orthosis : 37 Non foot orthosis: 37	Plantar fasciitis patients with an average age in the intervention group were 48 years old and in the control group were 53 years old	Examine the effect of using foot orthosis on pain *, quality of life, foot function, and plantar pressure in plantar fasciitis patients.	Did not examine the effect of using foot orthosis on pain, quality of life, foot function, and plantar pressure in plantar fasciitis patients.	Reduction in degree of pain

Author (Year)	Country	Study Design	Sample	P	I	C	O
Lunen et al., (2011)	Virginia	Randomized Controlled Trial	Foot orthosis : 17 Non foot orthosis: 17	Patients with unilateral and bilateral plantar fasciitis	Examine the effect of using foot orthosis on pain *, peak plantar pressure, and mean plantar pressure in plantar fasciitis patients.	Not examine the effect of using foot orthosis on pain, peak plantar pressure, and mean plantar pressure in plantar fasciitis patients.	Reduction in degree of pain
Yucel et al., (2013)	Turkey	Randomized Controlled Trial.	Foot orthosis : 20 Non foot orthosis : 20	Chronic unilateral plantar fasciitis patient	To examine the effect of us foot orthosis on the manag- ment of plantar fasciitis which includes pain *, thickness of the plantar fascia in plantar fasciitis patients.	Not examine the effect of using foot orthosis on the management of plantar fasciitis which includes pain, thickness of the plantar fascia in plantar fasciitis patients.	314 tion in degree of pain
Walther et al., (2013)	Germany	Randomized Controlled Trial.	Foot orthosis : 10 Non foot orthosis : 10	Plantar fasciitis patients with an average age of 51.6 to 53.9 years old.	Evaluating the effectiveness of foot orthosis in plantar fasciitis treatment which includes pain *, walking distance, and sucjective comfort of plantar fasciitis patients.	Not evaluating the effec- tiveness of foot orthosis in plantar fasciitis treatment which includes pain, walk- ing distance, and sucjective comfort for plantar fasciitis patients.	Reduction in degree of pain
Fong et al., (2012)	China	Randomized Controlled Trial.	Foot orthosis : 15 Non foot orthosis : 15	Unilateral plantar fasciitis patients aged 40-64 years old	Evaluating the use of foot orthosis on pain levels * and dynamic plantar pressure in plantar fasciitis patients.	Did not evaluate the use of foot orthosis on pain levels and dynamic plantar pressure in plantar fasciitis patients.	Reduction in degree of pain
Bishop et al., (2018)	Australia	Randomized Controlled Trial	Foot orthosis : 20 Non foot orthosis : 20	Patients with unilateral plantar fasciitis had an average age in the inter- vention group were 44.5 years old and in the control group were 44.7 years old.	To examine the effect of using foot orthosis on pain * and plantarfascia thickness in plantar fasciitis patients.	Not examine the effect of using foot orthosis on pain and plantarfascia thickness in plantar fasciitis patients.	Reduction in degree of pain

* Variables included in the meta-analysis

a. Forest plot

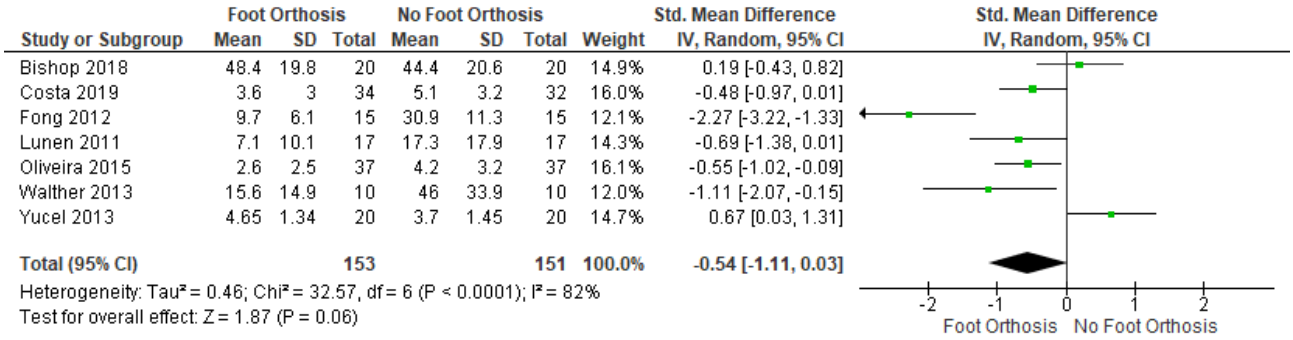

Figure 2. Forest plot of the effect of using foot orthosis to reduce the degree of pain

b. Funnel plot

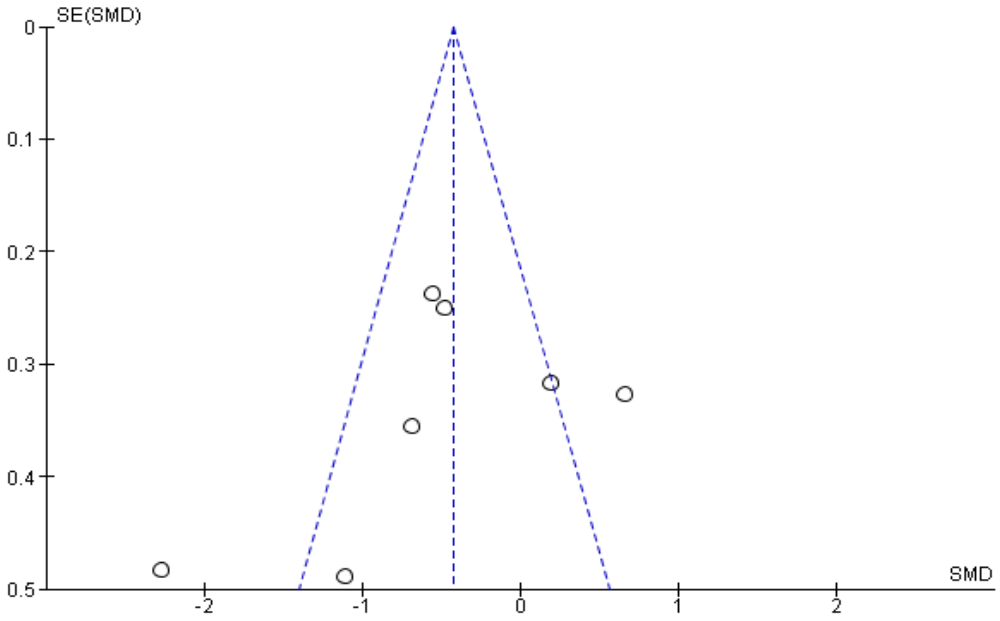

Figure 3. Funnel plot of the effect of using foot orthosis to reduce the degree of pain in plantar fasciitis patients

Based on the results of the forest plot (Figure 2), it showed that the use of a -0.54 foot orthosis reduced the degree of pain in plantar fasciitis patients compared to without using foot orthosis and it was statistically insignificant (p= 0.06). The heterogeneity of the study data showed I^2= 82% so that the distribution of the data was heterogeneous (random effect model). The funnel plot (Figure 3) showed a publication bias which was indicated by asymmetry of the right and left plots where 2 plots were on the right and 5 plots were on the left. The plot on the left of the graph has a standard error between 0.2 and 0.5 and the plot on the right has a standard error between 0.3 and 0.4. Bias also occurred from an imbalance between the distance between the studies on the right and left of the funnel plot.

DISCUSSION

Plantar fasciitis is a condition of abnormalities in the foot joint that can affect all ages, but usually affects groups of people aged 40-60 years old and can occur in active individuals or individuals who do not do much movement (Okur and Aydin, 2019). But for someone who has an abnormal foot, which is flat foot, it can occur at the age of less than 40 years old (Setyawan, 2016). In general, the prevalence rate ranges from 4% to 7% in the older population, 8% in athletes and up to 25% in runners (Whittaker et al., 2017).

The results of research conducted by Suzan stated that this fasciitis platar contributes 41.5% of problems in musculoskeletal cases in every tertiary care center in California, United States. Approximately 10% of the US population complains of the incidence of pain in plantar fasciitis cases and results in one million professional visits for plantar fasciitis treatment each year. In the United States, plantar fasciitis accounts for more than 600,000 outpatients each year (Goweda, 2015). Based on data obtained from monthly reports at the medical rehabilitation clinic of the Bhakti Wira Tamtama Army Hospital, Semarang, Central Java, in 2017 there were 67 patients who experienced cases of plantar fasciitis from January to December 2018.

This systematic and meta-analysis study raised the theme of the effect of using foot orthosis on reducing the degree of pain in plantar fasciitis patients. This study discussed data about pain which was considered important because of the effects that were caused if no follow-up treatment was given. Pain in plantar fasciitis occurs due to stretching or overloading of the longitudinal arch or due to loss of the longitudinal arch in the foot. The purpose of using a foot orthosis in this case was to provide support to the plantar area of the foot so that it can reduce pain and increase the static balance in the patient (Setyawan, 2016).

Systematic review and meta-analysis in this study were carried out with the aim of increasing the generalizability of the findings and obtaining convincing conclusions from the results of various similar studies regarding the use of a foot orthosis was -0.54 times better to reduce the degree of pain than without using a foot orthosis (ES= -0.54; 95% CI -1.11 to 0.03; p= 0.06). The results showed a reduction in pain. The heterogeneity of the study data showed I^2= 82%, which indicated the distribution of heterogeneous data, so that the analysis uses a random effect model. Therefore, from the results of meta-analysis, it showed that the use of foot orthosis has an effect on reducing the degree of pain in plantar fasciitis patients.

The results of the data analysis that have been carried out were in line with research conducted by Oliveira et al., (2015) which states that the use of foot orthosis can be used to reduce pain when walking and can increase walking distance in someone who has plantar fasciitis.

In principle, the plantaris fascia will stretch out if there is pressure on the body because the plantaris fascia serves as a shock absorber. When there is inflammation in the plantar fascia, pain will appear when there is pressure on the body. Foot orthosis can reduce pain because the tool works with its mechanism, namely that the heel pad will reduce or reduce the compressive force on the heel. Then the pressure on the heel will be distributed on the arch support to the forefoot. This equalization of pressure on the feet will relax the plantar facia. Biomechanically, the medial wedge will hold the weight of the foot, especially the midfoot, so that the plantar facia

attachment does not experience a stretching that causes pain. In addition, the medial wedge also functions to prevent pronation of the feet which causes the plantar fascia to stretch out (stretching). Therefore, the arcus area needs to be supported to reduce the body's compressive force so as to reduce the stretching power of the plantar fascia (Setyawan, 2016). Foot orthosis is used to help relieve tension and inflammation associated with inflammatory plantar fasciitis and degeneration of the thick bands of tissue that support the soles of the feet. This orthosis is made of a sponge and plastic material, which aims to provide support to the plantar area of the foot in order to reduce pain.

It can be concluded that the use of foot orthosis can reduce the degree of pain in plantar fasciitis patients, but it is not statistically significant.

AUTHOR CONTRIBUTION

Atika Febri Anggriani is the main researcher who selected a topic, explored and collected research data. Agus Kristiyanto and Setyo Sri Rahardjo had a role in analyzing data and reviewing study documents.

CONFLICT OF INTEREST

There was no conflict of interest.

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This study used private funds from the main researcher

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