

## Review Article

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# Taping for plantar fasciitis

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### Abstract.

**BACKGROUND:** Plantar fasciitis is considered the most common cause of foot pain. Numerous non-surgical treatments have been used to relieve symptoms. Taping is one of the most widespread treatments, with several techniques utilized in clinical practice.

**OBJECTIVE:** To evaluate, based on existing literature, the efficacy of different taping techniques in relieving symptoms and dysfunction caused by plantar fasciitis.

**METHODS:** PubMed, CINAHL, PEDro, ISI Web of Science, and Google Scholar databases were searched from inception until December 2012, using a predefined search strategy. Controlled trials of any methodological quality were included, without any language restrictions. The methodological quality of interventional studies was evaluated *inter alia* by the PEDro score.

**RESULTS:** Five randomized control trials, one cross-over study and two single group repeated measures studies met the inclusion criteria. Two studies were high quality; two were moderate quality and four were of poor methodological quality. All eight studies favored the use of different taping techniques. The most common technique was low dye taping.

**CONCLUSION:** We found that in the short-term, taping is beneficial in treating plantar fasciitis. The best evidence exists for low dye taping and calcaneal taping. More research is needed to investigate long-term effect and effectiveness of specific taping techniques.

Keywords: Conservative treatment, efficacy, plantar fasciitis, review, taping

## 1. Introduction

Plantar fasciitis is a painful inflammation of the plantar fascia. Pain often radiates from the central part of the heel pad or the medial tubercle of the calcaneus, but may also extend along the plantar fascia into the medial longitudinal arch of the foot. Severity may range from slight irritation at the origin of the plantar fascia to incapacitating pain [1]. This disorder is considered the most common cause of foot pain and is estimated to account for 11–15% of all foot problems in adults [2]. Plantar fasciitis occurs in approx-

imately 2 million Americans each year [3] and has been observed in athletic and sedentary populations, most prevalent in young runners and individuals between 40–60 years old [4]. It has been estimated that 7% of people > 65 have reported tenderness in the region of the heel [5]. Plantar fasciitis also occurs in 25% of all foot injuries related to running [6]. The exact pathology is still unknown, but histopathologic examination of biopsy specimens from patients undergoing excessive extension or microinjuries of the plantar fascia show secondary degenerative changes in the plantar fascia without acute inflammation, and with or without fibroblastic proliferation [7]. This disorder is thought to be multifactorial in origin and can be triggered by obesity, excessive periods of weight bearing activity and decreased ankle range of motion [3].

The plantar fascia is a thick fibrous connective tissue originating at the medial tuberosity of the calcaneus

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Table 1  
Methodological quality of selected articles according to the PEDro scale

PEDro criteria	Landrof et al. [23]	Radford et al. [25]	Hyland et al. [20]	Vishal et al. [21]	El Salam and Elhafz [26]
Eligibility criteria were specified	✓	✓	✓	✓	✓
Random allocation	–	✓	✓	✓	✓
Concealed allocation	–	✓	–	–	–
Baseline comparability	✓	✓	–	✓	✓
Blind subjects	–	–	–	–	✓
Blind therapists	–	–	–	–	✓
Blind assessors	–	–	–	–	✓
Adequate follow-up	✓	✓	✓	–	✓
Intention-to-treat analysis	✓	✓	–	–	✓
Between-group comparisons	✓	✓	✓	✓	✓
Points estimate and variability	✓	✓	✓	✓	✓
Total score (0–10)	5	7	4	4	9

and inserted into the plantar plates of the metatarsophalangeal joints, the base of proximal phalanges, and the sheaths of the flexor tendons. Therefore, when the toes are extended, the plantar fascia is functionally shortened. Hicks [8] was the first to use the term “windlass effect” of the plantar fascia to describe this functional shortening. The windlass effect can assist in supinating the foot during the pre-swing phase of the gait cycle. During loading, the plantar fascia allows for flexibility of the midfoot when conforming to the ground, thus providing shock absorption. Any change in the biomechanics of the foot may cause associated heel pain, which may lead to excessive pronation, a commonly cited risk factor in developing plantar heel pain [9,10]. There may also be a lowering of the medial longitudinal arch which creates excessive tensile strain within the plantar fascia, producing microscopic tears and chronic inflammation [11].

Numerous non-surgical treatments have been used to relieve symptoms associated with plantar fasciitis. These include anti-inflammatory agents (NSAIDs, steroid injections), modalities (iontophoresis, ultrasound, extracorporeal shock wave therapy, electrical stimulation, cryotherapy and whirlpool), manual therapy (joint and neural mobilizations, massage), stretching (including night splints), and external support (orthotics and taping) [12–14]. Most treatments endeavor to resolve the symptoms caused by plantar fasciitis; while orthotics and taping aim to repair the poor biomechanics of the foot.

Therapeutic taping is a common clinical intervention utilized in physical therapy facilitating pain reduction, joint support, proprioception, and muscle tone normalization. Taping is a simple procedure requiring no more than ten minutes to implement, resulting in an immediate positive effect on pain and occasionally on function. The rigidity of the tape allows a mechanical

change in joint position, i.e. posture correction when applied to the thorax [15], changing patellar inclination [16] foot pronation [17], etc.

Various techniques of heel taping have been suggested: low-dye taping (LDT) [18], high dye taping [19], calcaneal taping [20], plantar fasciitis taping [21] and windlass taping [22]. However, it is still unclear which methods are more effective in treating plantar fasciitis. Therefore, the aim of this review was to investigate the efficacy of different taping techniques in relieving symptoms and dysfunction caused by plantar fasciitis.

## 2. Methods

PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Physiotherapy Evidence Data (PEDro), Institute for Scientific Information (ISI) Web of Science, and Google Scholar databases were searched from inception until December 2012, using a predefined search strategy. Keywords and phrases used in the online search included “taping”, “adhesive tape”, “plantar fasciitis”, “plantar fasciosis”, “heel spur”, “heel pain” and “calcaneal”. Titles and abstracts of all articles were reviewed. Inclusion criteria included use of any type of taping methods in treating plantar fasciitis or heel pain and at least one pain or functional outcome. Trials of any methodological quality were included.

All published material was analyzed with an emphasis on randomized control trials (RCTs). No language restrictions were imposed. Reference lists of all articles retrieved in full were also searched.

The methodological quality of randomized controlled interventional studies was evaluated *inter alia* by the PEDro score (<http://www.pedro.org.au/>). The

Table 2  
Features of the reviewed studies

Study	Design	Study group (N)	Control group (N)	Age (years)	Pain duration (years)	Study group intervention	Control group intervention	# of procedures
Landrof et al. [23]	CCT	65	40	46.3	0.9	Low dye + sham US	Sham US	3
Radford et al. [25]	RCT	46	46	50 ± 14	0.83	Low dye + stretching	Stretching	1
Hyland et al. [20]	RCT	1. 10 2. 11	3. 10 4. 10	1. 34.1 2. 45.5 3. 37.6 4. 40.4	NR	Calcaneal	2. Stretching 3. Sham taping 4. No treatment	2
Vishal et al. [21]	RCT	30	30	38.4 ± 14	> 0.08	Plantar fasciitis taping + US + stretching	Calcaneal taping + US + stretching	1
El Salam and Elhafz [26]	RCT	15	15	52.8	> 0.08	Low dye + US + stretching	Medial arch support insoles + US + stretching	9
Van Lunen et al. [27]	Cross-over	17	—	34.8 ± 15	—	1. Low dye taping	2. Heel pain orthosis 3. No intervention	1
Ha et al. [28]	Repeated measures	19	—	—	—	Low dye taping	—	1
Jamali et al. [22]	Repeated measures	20	—	—	—	Windlass taping	—	1

LDT = low dye taping, MAS = medial arch support, US – ultrasound, CCT – controlled clinical trial.

PEDro score was calculated by one of the authors (L.K.) experienced in PEDro evaluation who compared the data available at the PEDro website or other publications. The PEDro 10 point scale takes into account two aspects of trial quality: the “internal validity” of the trial and whether the trial contains sufficient statistical information to interpret the data. It does not rate the “external validity” of the trial or the treatment’s effect size. The methodological quality of a trial was defined as high when five or more items on the PEDro scale received a positive score.

### 3. Results

Table 1 presents the PEDro scores of the reviewed papers. After filtering for clinically relevant studies, the effects of taping on plantar fasciitis were examined in five RCT’s, two cross-over studies and one single group repeated measures study (Tables 2 and 3).

Landrof et al. [23] investigated the short-term efficacy of a combined intervention of LDT and stretching versus stretching alone ( $n = 105$ ). Patients were treated three times a week. The authors found a statistically significant difference between the two groups (favoring combined intervention) in pain measured by the visual analogue scale (VAS) (31.7 mm difference,  $p < 0.005$ ) and in patient satisfaction (20% more improvement,  $p < 0.005$ ). This RCT was not rated on the PEDro site, but according to our rating and the rating

in a systematic review by van de Water et al. [24], the PEDro score was 5/10.

Radford et al.’s RCT [25] ( $n = 92$ ) compared a 1-week application of LDT plus sham ultrasound versus sham ultrasound alone. Validated participant-reported outcome measures were used (10 mm VAS to measure ‘first-step pain’ and the Foot Health Status Questionnaire (FHSQ) (0–100 scale) to measure pain, function, and general foot health). The result showed that LDT significantly improved ‘first-step pain’ at one-week compared with no taping (mean difference measured by VAS:  $-12.3$  mm, 95% CI  $-22.4$ – $2.2$  mm;  $p = 0.017$ ). No significant differences were found between groups in pain, function, or general foot health measured by the FHSQ (pain,  $p = 0.117$ ; function  $p = 0.193$ ; general foot health,  $p = 0.885$ ). The study was found to be of high methodological quality, 7/10 on PEDro scale.

Hyland et al. [20] in a smaller RCT ( $n = 41$ ) examined the influence of calcaneal taping on heel pain and function using calcaneal taping ( $n = 11$ ), sham taping ( $n = 10$ ), no treatment ( $n = 10$ ) and stretching ( $n = 10$ ). The authors found that calcaneal taping at one week, significantly improved pain compared with sham taping (mean VAS score: 2.7 mm with calcaneal taping and 6.0 mm with sham taping,  $p < 0.001$ ). Calcaneal taping also significantly improved pain compared with no treatment or plantar fascia stretches (mean VAS score: 2.7 mm with calcaneal taping, 4.6 mm with stretching and 6.2 mm with no

Table 3  
Studied variables and findings

Findings (Short term)	Outcome measures	Study
Landrof et al. [23]	a. pain (VAS: 0–100 mm) b. satisfaction (self-rated 4 point response scale: high level of satisfaction, moderate, no satisfaction, worse).	a. statistically significant improvement of pain 31.7 mm difference between groups b. statistically significant improvement with a 20% difference between groups
Radford et al. [25]	a. first step pain (VAS: 0–100 mm). b. foot pain, foot function, general foot health (FHSQ: 0–100)	a. Statistically significant improvement of pain with a 12.3 mm difference shown on the VAS scale b. No statistically significant difference was found between groups
Hyland et al. [20]	a. VAS (0–10) b. Self-rated functional limitations (PSFS: 0–10)	a. statistically significant improvement compared to the three other groups b. not statistically significant
Vishal et al. [21]	a. Foot Function Index for functional ability (FFI) b. pain (VAS: 0–10)	a. statistically significant improvement in both groups, 30 points average b. statistically significant improvement in both groups, 4 point average.
El Salam and Elhafz [26]	a. pain (VAS: 0–10) b. Manchester Foot Pain and Disability Schedule (1- not at all, 2- occasionally, 3-on most days or every day) (FPDS)	LDT VAS decreased by 0.8 points, MAS by 3.3, MAS FPDS decreased by 11.8 while LDT decreased by 5.8. Statistically significant improvement in both groups compared to baseline. Statistically significant improvement in MAS group compared to the LDT group.
Van Lunen et al. [27]	Pain (VAS: 0–100 mm)	Statistically significant improvement in both intervention groups, pain levels improved between 1 to 1.6 points.
Ha et al. [28]	Pain (VAS: 0–10)	Statistically significant improvement on the VAS - average of 1.91 points
Jamali et al. [22]	Pain (VAS: 0–100 mm)	Statistically significant reduction in the VAS score, 37 mm pre-tape and 6 mm immediately post-tape and 24 h later

Statistically significant  $\alpha < 0.05$ , LDT = low dye taping, MAS = medial arch support.

treatment; calcaneal taping and stretching,  $p = 0.006$ , calcaneal taping and no treatment,  $p < 0.001$ ). However, outcomes were not measured beyond one week. This study received 4/10 on the PEDro scale.

Vishal et al.'s [21] RCT ( $n = 60$ ) compared two different methods of taping techniques (calcaneal taping versus plantar fasciitis taping) in addition to ultrasound therapy and stretching in treating heel pain. Treatment consisted of a single taping application with a one week follow-up. The results showed that in both groups a statistically significant improvement in pain score and Foot Function Index (FFI) for functional ability from baseline was shown. The VAS score on average was reduced in both groups by 4.2 points ( $p = 0.0001$ ). The FFI score on average was reduced by 30 points in both groups ( $p = 0.0001$ ). No difference was found between the two groups. The study received 4/10 on the PEDro scale.

El Salam and Elhafz's [26] RCT ( $n = 30$ ) examined the effect of LDT or medial arch support in patients with plantar fasciitis. Both groups received nine ses-

sions over a three week period in addition to ultrasound and calf muscle stretching and were instructed to maintain supportive intervention (LDT or medial arch support) throughout. Pain was measured by the VAS and function by the Manchester Foot Pain and Disability Scale (FPDS) (1- no pain, 2- pain felt on some days, 3-pain felt on most days or every day). Pre-post comparison showed reduced pain and improved function in both groups (LDT VAS decreased by 0.8 points, medial arch support by 3.3,  $p < 0.05$ , and medial arch support FPDS decreased by 11.8 while LDT decreased by 5.8,  $p < 0.05$ ). Between-groups analysis showed a non-significant difference in pre-VAS and pre-FPDS. Post-VAS and post-FPDS showed a significant improvement in patients in the medial arch support group, concluding that medial arch support is more effective for short-term management of pain and disability in patients with plantar fasciitis. This study albeit relatively small, received 9/10 on the PEDro scale.

Van Lunen et al. [27] performed a single-group repeated measures study on 17 physically active or

sedentary individuals with plantar fasciitis assessing the effects of augmented LDT taping and heel-pain orthosis on pain measured by VAS, peak plantar pressure (PPP), and mean plantar pressure (MPP) while walking and jogging. Both PPP and MPP were evaluated after 45 seconds of walking and jogging during the 3 interventions (control, augmented LDT, heel-pain orthosis). Statistically significant improvement was found in both intervention groups; pain levels improved between 1 to 1.6 points. The authors concluded that heel-pain orthosis and augmented LDT produced statistically and clinically decreased VAS scores when walking and jogging.

Ha et al. [28] carried out a single-group repeated measures study evaluating the immediate clinical and biomechanical effect of LDT taping. Nineteen patients with fat pad tenderness or tenderness in the area of plantar fascia insertion participated. Plantar pressure change was calculated by foot pressure analysis; fat pad depth changes with ultrasonography, and pain improvement with VAS before and after LDT. Patients treated with LDT improved in their VAS score (mean 1.91 points,  $p < 0.05$ ).

Jamali et al. [22] performed a single-group repeated measures study on 20 subjects with plantar fasciitis aimed at investigating the effects of windlass taping on heel pain. Pre- and post-taping measures included pain levels using VAS, resting-stance calcaneal position, tibial position, and navicular height. After wearing the tape for 24 hours, 15 patients reported VAS pain. Windlass taping was found to be clinically and statistically significant in reducing pain (median VAS score 37 mm pre-tape and 6 mm immediately post-tape and 24 hours later,  $p = 0.001$ ).

#### 4. Discussion

Various taping techniques have been found to be beneficial in relieving pain caused by plantar fasciitis in the short-term. Rigid therapeutic taping was used in all the reviewed studies. The most common technique was the LDT (5 out of 8 studies). The aim of the LDT is to decrease medial heel pressure by lifting the navicular bone. The second most common technique was calcaneal taping [20] (2 out of 8 studies) which theoretically places the foot in an improved biomechanical position by repositioning the calcaneus closer to neutral alignment, thus increasing the medial longitudinal arch height. Plantar fasciitis taping [21] and windlass taping [22] were used in one study each, with no biome-

chanical explanation for its use. All taping techniques aimed at correcting foot biomechanics similar to foot orthotics, however, their advantage was the availability and possibility of adjusting the tape in accordance to the patient's anatomy and change in symptoms.

In clinical practice and in the majority of the reviewed studies, we found that the combination of taping with other modalities is presently being used. Reviewed studies also provided initial evidence that taping may decrease pain in the short term. Clinical resolution of plantar fasciitis symptoms usually takes several months [29], therefore taping should be considered as part of an intervention and not as a single treatment modality.

Several limitations were noted in the reviewed studies. Firstly, all studies investigated the short-term effect of taping; the longest follow-up was for only one week. We believe that additional studies are essential in order to investigate the long-term effect of taping.

Secondly, Radford et al. [25] reported an allergic reaction to the tape in 4 out of 46 individuals, indicating that taping should not be applied to those who are allergic to latex or have fragile skin, i.e. the elderly, children and patients with connective tissue disorders.

Thirdly, different taping techniques are used in clinics and trials; therefore, it was not feasible to compare the effectiveness of these techniques. Although Vishal et al.'s study [21] compared calcaneal and plantar fasciitis taping, no statistically significant difference was found between them. In addition, the highest quality trials were studied using LDT and calcaneal taping techniques. Further research on taping efficacy in treating plantar fasciitis, should concentrate on the most effective taping technique.

Fourthly, publication bias may exist since we found no studies showing negative results and it is possible that they were not submitted or accepted for publication.

#### 5. Conclusions

This review suggests that taping is a beneficial technique for plantar fasciitis in short-term treatment and can be implemented as an immediate pain reliever. We recommend using the techniques evaluated in the highest quality studies; LDT and calcaneal taping. Patients suitable for these techniques should be carefully chosen to avoid any adverse effect. Further research, especially RCTs with high methodological quality, are needed to investigate the medium and long-term effects

of taping, and compare the efficiency of taping techniques. Research as well, should focus on specific taping techniques, patient categories most susceptible for taping, and combined interventions.

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