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ORIGINAL ARTICLE

Extracorporeal Shockwave Therapy Versus Kinesiology Taping in the Management of Plantar Fasciitis: A Randomized Clinical Trial

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ABSTRACT

Objectives: This study aims to compare the efficacy of extracorporeal shockwave therapy (ESWT) and kinesiology taping in the treatment of plantar fasciitis.

Patients and methods: The study included 80 patients diagnosed with plantar fasciitis. The patients were randomized into two groups as ESWT (9 males, 28 females; mean age 47.8±12.4 years; range 40 to 55 years) and kinesiology taping (KT, 7 males, 26 females; mean age 47.7±9.8 years; range 40 to 55 years) groups. Groups were similar regarding age, sex, and body mass index (all p>0.05). Three patients in ESWT group and seven patients in KT group were lost to follow-up. ESWT was applied once a week for five weeks, while KT was applied every five days for five weeks. Patients' pain and functional status were evaluated with visual analog scale, heel tenderness index, and foot and ankle outcome score before and after treatment.

Results: At the study onset, there were no statistically significant differences between the two groups in their visual analog scale, heel tenderness index, and foot and ankle outcome scores. Five weeks later, both groups showed significant improvement in all parameters (p<0.05), but no significant differences were observed between the groups in the visual analog scale, heel tenderness index, and foot and ankle outcome score scores.

Conclusion: Both ESWT and KT treatments improved pain levels and function and quality of life in individuals with plantar fasciitis. Neither method was superior in treating plantar fasciitis.

Keywords: Extracorporeal shockwave therapy; kinesiology taping; pain; plantar fasciitis.

Plantar fasciitis (PF) is the most common cause of heel pain in adults. Although the exact cause is unknown, risk factors include middle age, obesity, excessive foot pronation, pes cavus, excessive running, pes planus, and prolonged standing.[1,2] The underlying condition for PF is tissue breakdown near the site of origin of the plantar fascia at the medial tuberosity of the calcaneus.[1,2] Patients may present with heel pain with their first steps in the morning or after prolonged sitting, and sharp pain with palpation of the medial plantar calcaneal region.[3,4] Stretching the plantar fascia and weight-bearing on the heel activate symptoms.[4]

Conservative therapy provides significant relief in approximately 90% of patients with PF.[1] Numerous methods are in use to treat PF, including nonsteroidal anti-inflammatory drugs, cortisone injections, foot orthoses, physical therapy, stretching exercises, night splints, and extracorporeal shockwave therapy (ESWT).[5-8] A small number of patients undergo surgery, including spur resection and release of all parts of the fascial band.[8] ESWT is a relatively new treatment used to alleviate heel pain, as well as other conditions, including tennis elbow, calcifying tendinopathy of the shoulder, and non-union fractures of the long bones.[9]

Another method for treating PF is kinesiology taping (KT), which is widely indicated in musculoskeletal pathologies. It facilitates circulation and motion, elevates skin and subcutaneous interstitial tissues, decreases inflammation and pain, increases performance, enhances

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neuromuscular re-education, prevents injury, and speeds recovery.[10] Different applications and indications are currently under investigation, and data are accumulating. Supportive taping is an effective short-term treatment for plantar heel pain.[11] Low-Dye taping is one of the most widely used techniques for treating PF.[12] To the best of our knowledge, no studies have compared ESWT and KT in the treatment of PF to date. Therefore, in this study, we aimed to compare the efficacy of ESWT and KT in the treatment of PF.

PATIENTS AND METHODS

We conducted this randomized clinical trial with a follow-up for five weeks at Konya Training and Research Hospital Outpatient Clinic of Physical Medicine and Rehabilitation Department between November 2015 and February 2016. A total of 99 consecutive patients with plantar heel pain were screened for admission into the trial. Of them, 19 consecutive bilateral PF patients were not considered. Thus, 80 patients satisfied the eligibility criteria and were randomized into two groups as ESWT and KT groups (Figure 1). In the ESWT group, three patients did not appear for their assigned treatment regularly; therefore, the group included nine males and 28 females (mean age 47.8±12.4 years; range 40 to 55 years). In the KT group, five patients did not appear for their assigned treatment regularly, and two patients received steroid injections due to severe pain; therefore, the group included seven males and 26 females (mean age 47.7±9.8 years; range 40 to 55 years). The diagnosis of PF was based on tenderness localized to the medial tubercle of the calcaneus, and pain that started with the first step in the morning and worsened with weight-bearing activity. Assessments were performed before the procedure and at five-week follow-up visit. The following inclusion criteria were used: pain *(i)* was reported with palpation of the plantar fascia, *(ii)* was localized and sharp but not radiating, *(iii)* was worse with the initial step after an extended period of rest, and *(iv)* decreased initially after the first few steps but exacerbated with increased activity.[13] Exclusion criteria comprised *(i)* history of previous steroid injections, *(ii)* previous foot surgery, lumbar spine disc herniation or back injury, or *(iii)* history of rheumatic disease. The study protocol was approved by the Medical Faculty of Selçuk University Ethics Committee. A written informed consent was obtained from each patient. The study was conducted in accordance with the principles of the Declaration of Helsinki.

The ESWT (Dornier Compact Delta: Germany) was performed once a week for five weeks, on the 12-15 Hz frequency setting; 2500 pulses at two-three bar pressure were applied. During ESWT sessions, patients were in a prone position with

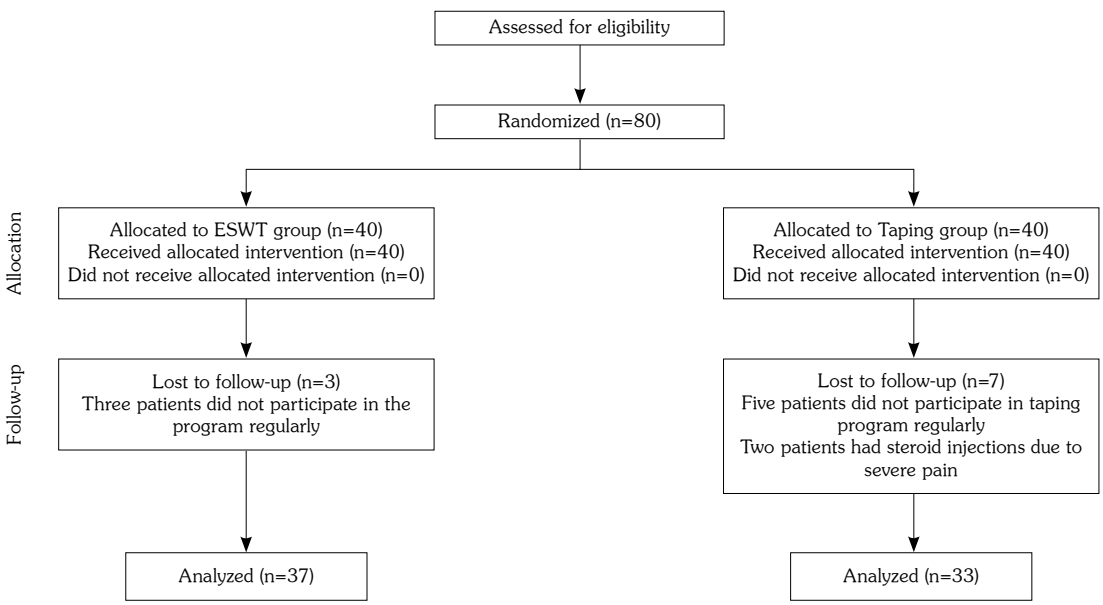

Figure 1. Flow diagram of patients recruited for this study. ESWT: Extracorporeal shockwave therapy.

Figure 2. Kinesiology taping protocol.

their feet extending beyond the examination table, and their knee and hip joints in a neutral position. Using ultrasound gel as a coupling medium, the head of ESWT shock wave device was applied to the inferior aspect of the calcaneus. The target area was the region of maximum tenderness in the medial calcaneus. No local anesthetic was applied. All patients were allowed for weight-bearing.

As part of the KT protocol, the target KT site was marked, starting from the posterior margin of the calcaneus bone and ending at the metatarsal joints. During the procedure, patients were in a prone position with their knee joints and ankle joints in a neutral position. Kinesiology tape was first applied from the calcaneus to the metatarsal heads with maximum stretching toward the plantar fascia. Four horizontal pieces were applied to the soles of the feet to support the medial arch. The first horizontal piece was applied from the lateral malleolus to the medial aspect of the foot, and then the second piece was applied from the medial malleolus to the lateral aspect of the foot. The third and fourth pieces followed the same pattern with an overlap of approximately one-third of the width of the tape. The horizontal pieces were applied with maximum stretching (Figure 2). The KT procedure was repeated every five days for five weeks.[10] The tape (Kinesio Tex, Kinesio Taping, US) used for this study was waterproof, porous, and adhesive.

Pain levels were assessed using a 100 mm horizontal visual analog scale (VAS) and physician assessment of heel pain on palpation using the heel tenderness index (HTI: 0= no pain, 1= painful, 2= painful and winces and 3= painful, winces and withdraws). Pain levels were assessed before and after the treatment.

Function and quality of life were measured using the foot and ankle outcome score (FAOS).[14] The FAOS is a 42-item questionnaire divided into five subscales: pain, other symptoms, activities of daily living, sports, and recreation function and foot and ankle-related quality of life. The pain subscale contains nine items, the other symptoms subscale contains seven items, the activities of daily living subscale contains 17 items, the sports and recreation function subscale contains five items, and the foot, and ankle-related quality of life subscale contains four items. Each question is scored on a 5-point Likert scale (from 0 to 4), and each of the five subscale scores is calculated by adding the included subscale items. The raw scores are then transformed into a final score of 0 to 100 (from worst to best outcomes). The reliability of the Turkish FAOS was previously verified.[14]

Concealed allocation of subjects was performed by using a computer-generated randomized table of numbers created before the beginning of the study. All outcome measures were collected by the same researcher, who was blinded to the patient group assignment at the beginning of the study and at the five-week follow-up.

Statistical analysis

The SPSS for Windows 15.0 software package (SPSS Inc., Chicago, IL, USA) was used for the statistical evaluation of the data. Conformity of continuous variables with normal distribution was investigated using the Kolmogorov-Smirnov test. All variables were distributed normally. Descriptive data were presented as the mean ± standard deviation. Demographic and clinical characteristics were compared using the Chi-square test. Within-group and between-group differences were investigated. The independent samples t-test was used to compare the two groups. The paired-samples t-test was used to analyze the differences between the baseline and after treatment values. A p value less than 0.05 was considered statistically significant.

RESULTS

The ESWT and KT groups were similar regarding age, sex, and body mass index (all $p>0.05$) (Table 1). At the study onset, there were no statistically significant differences between the two groups in their VAS and HTI scores, and FAOS.

Table 1. Demographic and clinical characteristics of patients

	ESWT (n=37)		KT (n=33)		
	n	Mean±SD	n	Mean±SD	*p*
Age (year)		47.8±12.4		47.7±9.8	0.642
Sex					0.965
Female	28		26		
Male	9		7		
Body mass index (kg/m^2)		32.2±4.9		31.9±7.2	0.343

ESWT: Extracorporeal shockwave therap; KT: Kinesiology taping; SD: Standard deviation; Chi-square test.

Five weeks later, both groups showed significant improvement in all parameters within the groups (all p<0.05), but no significant differences were observed between the groups in the VAS and HTI scores (Table 1) and FAOS (Table 2).

DISCUSSION

In this randomized study, we compared ESWT to KT in patients with PF. To our knowledge, this is the first study to compare ESWT with KT. We observed significant improvement in the VAS and HTI scores, and FAOS in both groups. Possible benefits of KT include increased interstitial space, promoting better blood and lymph flow in the region, decreased inflammation and pain, and quicker recovery.[10] The efficacy of arch support taping in patients with PF has been shown in previous studies.[11-13,15-19] Several techniques are utilized in clinical practice. The most common techniques are low-Dye taping and augmented low-Dye taping.[12,15,18] Taping applications that decrease pronation are short-term interventions that have been shown to reduce pain in participants with PF.[13,16] Low-Dye taping and augmented low-Dye taping decrease pronation and increase dynamic medial longitudinal arch height during walking and jogging.[15,18,19] Additionally, KT has been found to decrease pressure under the medial and lateral rearfoot while walking.[15,17] Low-Dye taping supports the longitudinal arch of the foot. It has been shown to significantly reduce peak plantar pressures of normal feet during gait, especially the peak plantar pressure in the medial midfoot, and thus could reasonably be expected to help in the management of PF.[20,21] A recent clinical practice guideline[8] recommends that over-the-counter arch support should be considered as part of initial treatment options. Low-Dye taping supports the longitudinal arch of the foot, so low-Dye taping may be a viable alternative to foot orthoses for individuals who cannot tolerate the plantar pressures of an orthotic or for footwear that will not accommodate conventional insoles.

Like KT, ESWT is widely used in the treatment of PF. The efficacy and safety of ESWT on chronic PF have been demonstrated in several randomized clinical trials.[22-26] ESWT causes extreme excitement of the axon, destroys unmyelinated sensory fibers, improves symptoms by initiating an inflammatory

Table 2. Assessment of functional parameters

	ESWT (n=37)	KT (n=33)	ESWT vs.KT
	Mean±SD	Mean±SD	*p*
Visual analog scale			
Baseline	6.9±1.7	7.4±2.0	0.670
After treatment	3.8±1.8	3.6±2.3	0.584
p	0.037†	0.036†	
Heel tenderness index			
Baseline	1.9±1.0	2.1±1.2	0.731
After treatment	0.6±0.5	0.8±0.5	0.673
p	0.024†	0.028†	

ESWT: Extracorporeal shockwave therapy; KT: Kinesiology taping; SD: Standard deviation; † Baseline versus after treatment; Samples t-test, paired-samples t-test; p<0.05.

Table 3. Comparison of foot and ankle outcome score

	ESWT (n=37)	KT (n=33)	ESWT vs. KT
	Mean±SD	Mean±SD	*p*
FAOS pain			
Baseline	45.7±17.2	41.8±17.5	0.721
After treatment	55.8±11.2	56.9±10.9	0.643
p	0.019†	0.018†	
FAOS symptoms			
Baseline	57.5±24.9	57.0±24.0	0.921
After treatment	68.3±25.0	66.9±22.3	0.345
p	0.024†	0.027†	
FAOS ADL			
Baseline	43.6±19.1	46.6±17.6	0.611
After treatment	57.8±21.5	59.8±20.3	0.673
p	0.020†	0.018†	
FAOS SPORT			
Baseline	41.4±21.2	42.8±19.5	0.651
After treatment	55.9±26.9	57.2±24.2	0.724
p	0.021†	0.021†	
FAOS QOL			
Baseline	44.5±9.4	46.8±1	0.856
After treatment	58.6±14.6	62.8±2	0.584
p	0.019†	0.020†	

ESWT: Extracorporeal shockwave therapy; KT: Kinesiology taping; FAOS: Foot and ankle outcome score; ADL: Activities of daily living; SPORT: Sports and recreational activities; QOL: Quality of Life; † Baseline versus after treatment; Samples t-test, paired-samples t-test; $p<0.05$.

response to the secretion of growth factors or nitrous oxide and revitalizes tissues by increasing angiogenesis.[3,9] Some researchers have reported that ESWT is effective in the treatment of PF in comparison to a control group.[25,26] However, other relevant studies have found no benefit to ESWT for PF.[27,28] This discrepancy may be explained by methodological differences. For example, the use of local anesthesia,[23,29,30] applicator position,[23] and the use of different energy densities of ESWT[31] are all factors that may have affected study results. In a study by Lee et al.,[31] a medium-energy (0.16 mj/mm^2) ESWT group showed statistically significant pain reduction and improved function scores compared to a low-energy (0.08 mj/mm^2) group. In another study, Park et al.[32] measured the long-term effects of ESWT on PF and found that subjective pain began to decrease one week after the first treatment session, and continued to improve with time, up to a mean of 24 months. KT and ESWT have several advantages over surgery in the treatment of PF. Both ESWT and taping do not require patients to avoid weight-bearing, and allow patients to return to work and the activities of daily life within just one or two days.

Both ESWT and KT have been shown in previous studies to be effective in treating PF.[13,15-21,25,26] In our study, neither method was found to be superior in treating PF.

The major limitation of our study is the lack of a control group, while other limitations include a short follow-up duration, and absence of objective evaluations of the plantar fascia, such as ultrasonography. Nevertheless, a five-week follow-up period is common in many studies for evaluating pain, and the effect of pain on daily activities, in the management of PF.[6] Ultrasonography is an effective diagnostic imaging tool for PF,[6,32] and the absence of ultrasonographic measures of the thickness of the plantar fascia is another limitation of this study.

In conclusion, both ESWT and KT treatments improved pain levels and function and quality of life in individuals with PF. Neither method is superior in treating PF. In the future, well-designed case-control studies evaluating the long-term effects of these treatments should be conducted.

Declaration of conflicting interests

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