K Int J Health Sci. October 2024;Vol 7(1): 17-23

KIJHS KASAV-INT JOUR HEALTH SCI ORIGINAL ARTICLE /// Open Acces

Clinical and functional evaluation of patients with plantar fascıitis: A clinical study

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The authors report no conflict of interest.

ABSTRACT

BACKGROUND: *Plantar fasciitis (PFs) is the most common cause of heel pain. Although the prevalence of PFs is high, information on patho-anatomy of this disease in the literature is lacking. In our study, we aimed to understand the association of physical examination findings and radiological parameters with the disease in normal healthy people and in patient swith PFs.*

MATERIAL AND METHODS: *Thirty consecutive patients with diagnosed PFs were included in the study. Thirty healthy volunteers consisted control group. Detailed physical examination was done. American Orthopedic Foot and Ankle Surgeons (AOFAS) scale was used to determine disability score. Body mass index (BMI) was calculated. Passive ankle and subtalar joints motion range was determined. Ultrasound was used for measuring thickness of plantar fascia.*

RESULTS: *Mean age of patients with was 50.40±10.32 years. Mean age of healthy volunteers was 48.25±9.40 years. At the end of our study, ankle dorsiflexion and eversion angles, AOFAS scores were significantly lower in group of plantar fasciitis (p<0.05). In addition, there was a negative correlation between calcaneus thickness and ankle dorsiflexion and eversion angles at US. There was a positive correlation between AOFAS scores and dorsiflexion. There was a negative correlation between AOFAS scores and calcaneal thickness size.*

CONCLUSION: *Limitations of dorsiflexion and eversion in patients with PFs which is most frequent cause of heel pain seems to be an important criterion in patient treatment and follow up.*

KEYWORDS: *AOFAS scores, Plantar fasciitis, calcaneal thickness*

Received 12.09.2024 Accepted 28.10.2024

INTRODUCTION

Plantar fasciitis (PFs), the most frequent cause of heel pain, is characterized by inflammation of foot plantar aponeurosis and consists 15% of all foot problems (1,2).

Although its occurrence frequency is highest, the etiology of disease is not fully understood. PFs has also been associated with biomechanical anomalies such as rigid Achille's tendon, pes cavus and pes planus (3,4). PFs is a condition affecting mostly people who perform physical exercise and who is working at standing position for long period (4). The exact histopathology of PFs is not clear. Currently it is considered as secondary to myxoid degeneration, microtrons within plantar fascia, collagen necrosis and angiofibroblastic hyperplasia of plantar aponeurosis and it is due to an inflammatory process (5). It can be idiopathic as well as it may co-exist with inflammatory disease such as seronegative spondylarthropathy and rheumatoid arthritis or it can develop following trauma (6). Typically, patient has heel pain following resting period or at the first steps in the morning at waking up time. The pain is gradually reduced by usual walking, however it becomes worse as walking time increases. The tenderness at the attachment site of plantar fascia to calcaneus medial tubercle is a pathognomonic finding. PFs is diagnosed by patient history and physical examination. Ultrasonography (USG) is not routinely used for diagnosis of disease, however it demonstrates thickness at the site of attachment of plantar aponeurosis to calcaneus and diffuse and localized hypoechoic areas (7).

Idiopathic form is considered mainly due to mechanical causes (8,9). Some of the common risk factors include prolonged standing, obesity, choice of inappropriate shoe, excessive foot pronation, jogging and reduced dorsiflexion (10,11). In addition, the degree of foot arch is also reported to affect thickness of plantar fascia and plantar fasciitis (9).

PFs is a disease of which the etiology is not clear. Information on the etiology is also lacking in the literature. We planned our study in order to clarify this subject and to develop new treatment protocols by performing detailed physical examination. In our study, we assessed the relationship between ankle range of motion and thickness of plantar fascia at USG and AOFAS.

MATERIALS AND METHODS

Forty consecutive patients with chronic heel pain and firstly submitting to our hospital were evaluated prospectively. Inclusion criterion was the presence of PFs diagnosis. PFs diagnosis is mainly based on clinical history and physical examination. All patients complained from pain and tenderness at the attachment site of plantar fascia to the bone on medial calcaneal tubercle and patients have first step pain (initials steps before loading the weight are important). Patients with history of systemic inflammatory disease, diabetes mellitus, tarsal tunnel syndrome, calcaneal stress fracture, foot surgery or other musculoskeletal disorder or trauma affecting lower extremity function, were excluded. Patients with bilateral PFs were also excluded because we planned to determine the real impact of disease on quality of life and to compare with other parameters. Patients with symptoms presenting for less than 6 months as well as patients with previous foot surgery, non-steroid anti-inflammatory drug administration and steroid injection at calcaneus were also excluded. Finally, 30 patients with diagnosed unilateral idiopathic PFs were included in the study. Thirty healthy volunteers consisted control group. Patients were excluded according to above mentioned exclusion criteria. Patients with history of heel pain were also excluded.

All patients signed written consent form of the study. The study was approved by local ethic committee. All subjects were randomly assigned to the groups. Physical examination and then clinical evaluation were performed by same physician on the same day. American Orthopedic Foot and Ankle Surgeons (AOFAS) scale was used for disability score. American Orthopedic Foot and Ankle Surgeons (AOFAS) scale total score is 100 points. Each item is based on both subjective and objective evaluation and scored per clinical observation and finding. Each of four measurements (i.e, ankle -dorsal part of foot, mid-foot, toe and smaller toes) were classified into 3 categories as pain, function and alignment. In addition, comments and criterion were given to each item for scoring. (12). Body mass index (BMI) was calculated for every patient as weight (kg)/height $(m)^2$.

Ankle dorsiflexion was determined by goniometer (13). At knee extension position, examining person kept subtalar joint at neutral position to prevent wrong measurement and then measured foot dorsiflexion until feeling a precise endpoint. Goniometer was marked by steps of 1° and placed on lateral site of ankle joint keeping the joint of goniometer on lateral malleolus.

US examination of all patients was done by same sonographer (AK) experienced at US Office for 10 years. US examination was done by 10-5 MHz linear sequence transformer (Acuson X300, Siemens, Germany). Patients were kept face down on examination table with foot swinging from table and stretching plantar fascia during foot dorsiflexion to see clearly the margins. Vertical images were obtained. US made diagnosis in case of fascia thickening > 4.5 mm (13,14) (Figure 1). Thickness of plantar fascia was measured from the part with greatest thickness and attachment site of calcaneus in every patient.

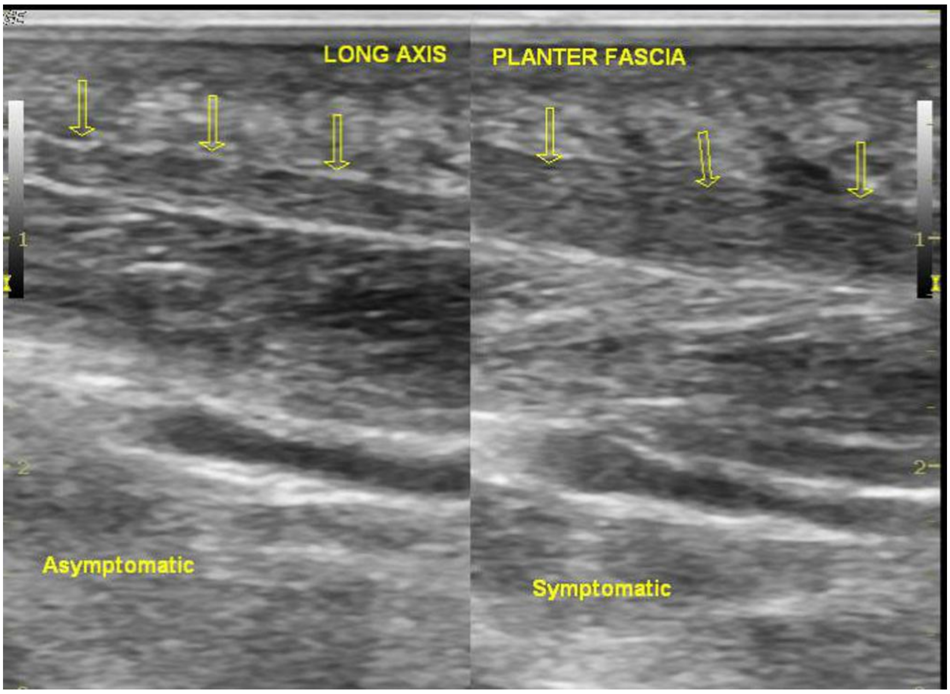

Figure 1. US image of plantar fasciitis.

Analysis was done by Version 16.0 (SPSS Inc., Chicago, IL, ABD) software for Windows of Statistical Pack for Social Sciences. Kolmogorov-Smirnov test was used to confirm that data of both groups was within normal distribution range. Non-parametric test was used for variables without normal distribution. Independent sampling t test was used for comparison of data between groups. Statistical significance was considered as $p<0.05$ with 95% confidence interval.

RESULTS

Overall, 30 feet with PFs diagnosis were included in the study (Figure 2).

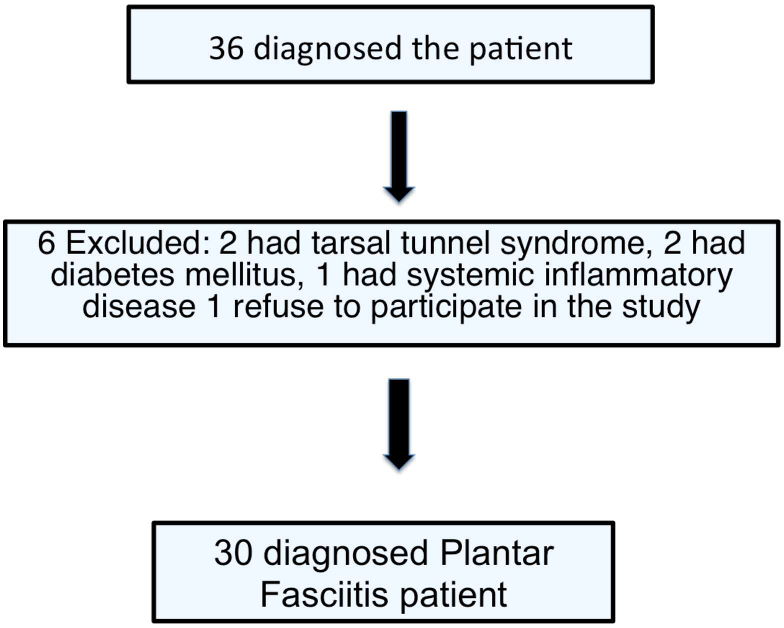

Figure 2. Study flowchart.

Demographics of patients and control group were presented in **Table 1**. Right foot was affected in 15 (50%) and left foot was affected in other 15 (50%). Clinical properties and radiography parameters of patients and control group were presented in **Table 2.** In addition, a negative correlation was detected between calcaneal thickness at US and ankle dorsiflexion and eversion angles ($p<0.05$, $r = -308$), ($p<0.05$, $r = -579$). A positive correlation was detected between AOFAS scores and dorsiflexion ($p<0.05$, $r = 521$). A negative correlation was detected between AOFAS scores and calcaneal thickness ($p<0.05$, $r = -579$).

Table 1. The demographic parameters of patients with plantar fasciitis and control group

	Patient Group	Control Group	p
Sex (male/female)	4/26	5/25	>0.05
Age	50.4±10.32	48.25±9.40	>0.05
BMI (kg/m^2)	29.78±4.32	25.51±4.13	<0.05

Table 2. The clinical and radiological parameters of patients with plantar fasciitis and control group

	Patient Group	Control Group	p
Plantar Flexion (0-50)	35.20±10.14	36.20±6.77	>0.05
Dorsiflexion (0-20)	11.36±12.12	18.86±2.06	<0.05
Inversion (0-35)	26.13±7.03	28.83±7.37	>0.05
Eversion (0-15)	10.06±5.80	14.56±3.79	<0.05
AOFAS	71.33±9.69	94.03±4.64	<0.05
US	4.87±1.19	2.13±0.82	<0.05

DISCUSSION

In our study, we evaluated physical examination findings, AOFAS scores and US findings of patients with PFs. Our study showed significantly lower degrees for ankle dorsiflexion and eversion, AOFAS scores in group of patients with PFs (Table 2).

Development of micro-ruptures at the attachment site of calcaneus by increasing load on plantar fascia is the theory mostly suggested in the etiology of PFs. Many factors such as foot anatomy, joint motion range, body mass index or activity level are known to affect the load on plantar fascia. Plantar fascia provides a strong mechanical liaison between calcaneus and toes extending from calcaneus to tip of metatarsi and basis of phalanxes (15,16). Hicks showed that toe dorsiflexion resulted in stretching of ligament and elevation of longitudinal arch of foot due to this anatomic structure (17). Plantar fascia has an important contribution to maintenance of foot longitudinal arch as well as to the anatomy of transverse arch (18,19). It has almost a connecting system between longitudinal and transvers arches of the foot (20). An appropriate gait pattern is based on complete range of motion and proper alignment of lower extremity joints. Alignment disorders and limping lead to abnormal loading on all body parts, especially foot plant. During normal gait, minimum 10° of ankle dorsiflexion is required (21). A decrease in this angle results in excessive pronation of mid-foot and in turn, this increases the load on plantar fascia. In PFs patients, restriction in ankle movement has been detected (22). In their study of comparison with control group, Riddle et al. indicated the important role of reduced ankle dorsiflexion and higher BMI values in development of PFs (23). In our study, also, BMI values of patients with plantar fasciitis were significantly higher. Ankle range of motion, mean values of dorsiflexion and eversion angle were significantly restricted in group of patients with PFs compared to healthy control group.

PFs is a group of disease with not fully understood in respect of etiology. There is a relationship between ankle range of motion, mean values of dorsiflexion and eversion angle and PFs; this should be considered in evaluation of patients and creating treatment programs and PFs should be evaluated in patients with restriction. At physical examination, ankle restriction should be recorded and monitored along with other parameters during patient follow up. During preparation of exercise programs, Achille stretching and plantar fascia stretching exercises should be added to treatment protocol (24). In addition to these exercises, stretching for eversion should be added also to exercise protocol for eversion restriction detected in our study.

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