Egyptian Rheumatology and Rehabilitation

RESEARCH Open Access

Deep friction massage versus local steroid injection for treatment of plantar fasciitis: a randomized controlled trial

Abdelhfeez Moshrif[1*], Mohamed Elwan[1] and Osama S. Daifullah[2]

Abstract

Background: Deep friction massage (DFM) has long been proven to be effective in treatment of some tendinopathies. The aim of our study was to evaluate the efficacy of this physical modality in the treatment of plantar fasciitis in comparison with local steroid injection.

Results: Sixty patients were assigned into 2 groups through a computer-based randomization table and completed the treatment and follow-up assessments; thirty in group I received 40 mg local triamcinolone injection and thirty in group II received 7 sessions of DFM. Demographic data showed a statistically insignificant difference in age, female to male ratio, and body mass index (BMI) in both groups. The mean for age was 39.42 years in group I and 41.32 years in group II ($P = 0.86$); the female to male ratio was 3:1 in group I and 2.75:1 in group II, and the mean for BMI was 32.41 in group I and 33.31 in group II ($P = 0.51$). At 2 and 6 weeks follow-up, DFM led to less improvement in pain and function compared to local steroid injection ($P = 0.001$ and 0.002 for pain and $P = 0.001$ and 0.001 for function respectively at both time points of follow-up).

Conclusions: This study revealed that deep friction massage is not effective as a single method in treatment of the plantar fasciitis. However, it can be used as an adjuvant physical modality. Further, large scale studies are needed to support this observation.

Trial registration: Pan African Clinical Trial Registry PACTR202004672785790. Date of registration 16 April 2020, "retrospectively registered."

Keywords: Plantar fasciitis; Deep friction massage; Local steroid injection

Key messages

To our knowledge, this is the first study to evaluate the effectiveness of deep friction massage as a single modality for the treatment of plantar fasciitis. While this physical modality has been claimed to be effective for treatment of some tendinopathies, this efficacy could not be confirmed in this study for plantar fasciitis.

Background

Plantar fasciitis (PF) is a common pathological condition that can lead to significant pain and disability [1]. It has been reported as the third most common running-related health problem [2] but can also affect non-athletes and less active elderly people [3]. PF occurs in a wide range of age with the mostly affected being between 40 and 60 years [4]. While the main cause of the condition is not known, several risk factors have been reported, but the most accepted theory is repetitive micro tearing and subsequent chronic inflammation of the plantar fascia at its insertion to the medial calcaneal tubercle [5].

Although often self-limiting, about 10% of patients may have persistent pain and marked disability [6]. Several interventions are routinely used for treatment of the condition including arch supports, strapping, heel pads, extracorporeal shock wave therapy, laser,

* Correspondence: Dr.moshrif@azhar.edu.eg
[1]Department of Rheumatology and Rehabilitation, Faculty of Medicine, Al Azhar University, Al Azhar University Square, Assiut 71524, Egypt
Full list of author information is available at the end of the article

topical applications, and surgical interventions [7]. Local injection using long acting steroids has been reported as an effective method for decreasing pain and improving function in PF especially on the short term [8, 9].

Although physical modalities resemble the cornerstone in the conservative treatment of PF, evidence is lacking which method is more effective [10].

Deep friction massage (also known as cross friction massage) has long been studied as a physical treatment for many musculoskeletal conditions especially tendinopathies depending on the fact that it can promote optimal collagen healing by increasing circulation and decreasing collagen cross linking [11].

It has recently been shown to be effective in the treatment of lateral epicondylitis [12].

However, there is a scarcity of studies about the use of this modality in podiatry problems as PF.

In this study, we aimed to evaluate the efficacy of DFM in the treatment of plantar fasciitis.

Methods

Between November 2018 and May 2019, a total of 60 adult patients with plantar fasciitis were selected from those attending the outpatient clinics of the rheumatology and rehabilitation departments of our institutions after giving an informed consent and completed the follow-up assessments (flow diagram Fig. 1). Patients were diagnosed as having plantar fasciitis according to the following criteria which have been proposed by the International Statistical Classification of Diseases and Related Health Problems (ICD) category of plantar fasciitis [13]:

- pain in the plantar medial heel region on palpation
- pain most noticeable with initial steps after a period of inactivity but also worse following prolonged weight bearing; and
- pain often precipitated by a recent increase in weight-bearing activity.

Exclusion criteria included patients with diabetes mellitus, peripheral vascular disease, and those who previously received systemic or local steroid injection within 3 months or locally injected with any other material and those who had rheumatic or connective tissue diseases or Achilles tendinopathy. Patients with foot pain due to arthritis, trauma, infection, or neurological problem and those with previous surgical intervention in the heel were also excluded. The study was approved by our institutions ethical committees and it conforms with the declaration of Helsinki for human experimentations. This study adheres to 2010 CONSORT guidelines.

Procedure

The data collected from each patient included age, gender, disease duration, previous treatments, body mass index (BMI), and the presence of associating low back pain and sciatica. Plain radiography was done for each affected heel on lateral view for diagnosis of associating calcaneal spur. Before treatment, at 2 weeks and 6 weeks follow-up, patients were instructed to identify the degree of pain felt with the first steps after long standing and in the early morning using the visual analog scale (VAS) from 0–10 where zero resembles no pain and ten resembles the worst pain and to complete the questionnaire about the function level and activity using the first seven items of the foot function index (FFI) as the remaining two items are related to orthotic use and were not applicable in this study [14].

According to a computerized randomization table, the patients were randomly assigned into the following two groups including the patients that completed the follow-up assessments:

Group I: thirty patients (41 heels) receiving local injection with triamcinolone acetonide 40 mg/1 ml plus lidocaine 2%/1 ml. The affected heel was completely sterilized and then slowly injected using the medial approach into the most tender point while the patient is in supine position. The patients were then advised not to do any long standing or walking activity for 2 days.

Group II: thirty patients (36 heels) receiving 7 sessions (10 min each) of deep transverse friction massage (DFM) performed every other day by a well-trained nurse in the physical therapy units as follows: with the reinforced thumb, a friction massage was applied transversely across the plantar fascia from proximal to distal on the most tender point in a rate of about 2 to 3 cycles per second within the patient's tolerance.

Statistical analysis

Statistical analyses were performed using SPSS Ver. 21.0 (SPSS Inc/IBM, Chicago, IL, USA). Categorical variables were described by number and percent (No and %), where continuous variables were described by mean and standard deviation (mean ± SD). Chi-square and Fisher's exact tests were used to determine the differences in proportions for each variable. Analysis of variance (ANOVA) was performed to compare means of continuous variables between the two groups. P value of less than or equal to 0.05 was considered significant.

Results

The numbers of participants who were randomly assigned, received intended treatment, and were

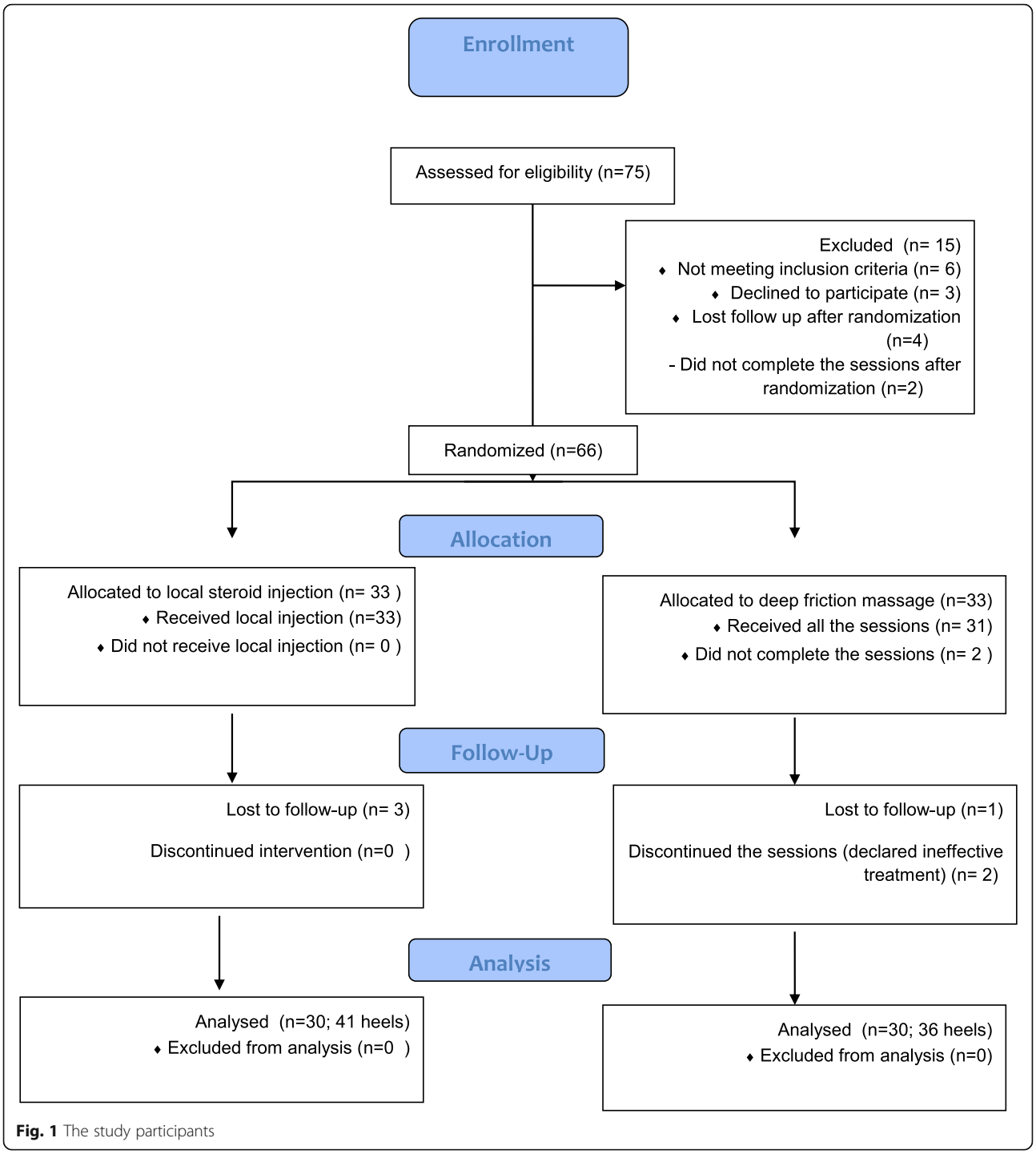

Fig. 1 The study participants

analyzed for the outcome measures are shown in the flow diagram (Fig. 1). The mean age of our patients was 39.42 years (range 19–65) in group I and 41.32 (range 23–63) years in group II ($P = 0.86$), and the female to male ratio was 3:1 in group I and 2.75:1 in group II. Bilateral PF was diagnosed in 25% of all patients. X-ray diagnosed the presence of calcaneal spur in 73% and 91% in group I and II respectively. The demographic and clinical features are shown in Table 1.

At the follow-up assessments, there was a significant difference between the two groups with more improvement of pain and function in the group of local steroid injection ($P = 0.001$ at 2 weeks and 0.002 at 6 weeks for pain depending on the mean VAS), while for function

Table 1 Demographic and clinical findings of patients

			Group I: LSI	Group II: DFM	*P* value
Age	Male		38.40 ± 10.27 (19–66), 10 N	42.75 ± 9.53 (29–60), 8 N	0.09
	Female		40.36 ± 9.34 (22–62) 20 N	39.62 ± 9.49 (28–65), 22 N	0.10
	Total		39.42 ± 10.21 (19–66), 61 N	41.32 ± 9.43 (28–65), 61 N	0.87
Disease duration			4.31 ± 6.02 (1–26)	5.37 ± 11.50 (1–21)	0.1
BMI			32.41 ± 5.06 (21–43)	33.3 ± 5.54 (19–39)	0.52
Affected side		Right	11 (36.66%)	9 (30%)	0.536
		Left	10 (33.33%)	15 (50%)	
		Bilateral	9(30%)	6 (20%)	
Calcanean spur	Total, *N* (%)	Present	30 heels (73%)	33 heels (91.6%)	0.506
		Absent	11 (27%)	3 heels (8.3%)	

BMI body mass index, *DFM* deep friction massage, *LSI* local steroid injection

$P = 0.001$ and 0.001 at 2 and 6 weeks depending on the mean FFI (Table 2).

Discussion

Current treatment of PF includes several physical and rehabilitation modalities as stretching exercise, arch supports, laser, and extracorporeal shock wave therapy [7]. Deep friction massage (DFM), developed by Cyriax [15], is a well-known manual treatment for tendinopathies. Cyriax proposed that DFM can lead to traumatic hyperemia and increased blood flow to the tissue, diminution of adhesions, and mechanoreceptor stimulation. It has been also hypothesized that DFM acts through the gate control theory by modulating the nociceptive impulses and inhibition of the A-delta C fibers at the level of the spinal cord which are responsible for transmitting the pain by stimulating the large fibers [16].

Myofascial technique, a deep manual method similar to DFM, has been hypothesized to enhance fibroblast proliferation and promoting collagen synthesis that may lead to healing of PF by replacing the degenerative tissue with a more functional one [17]. To the best of our knowledge, this is the first study to evaluate the efficacy of DFM in improving the pain and function in patients with plantar fasciitis in comparison with local steroid injection as an established extensively studied short-term method of treatment [10]. We adopted the visual analog scale for pain assessment and the first seven items of the FFI to measure the function and daily living activities as previously reported [18, 19].

Table 2 Outcome measures at 2 and 6 weeks follow-up

	Group I: LSI	Group II: DFM	*P* value
VAS at baseline	7.8 ± 1.8	7.6 ± 2.06	0.46
VAS at 2 weeks follow-up	3.2 ± 1.08	6.1 ± 2.03	**0.001**
VAS at 6 weeks follow-up	2.6 ± 1.4	6.2 ± 2.01	**0.002**
FFI at baseline	27.61 ± 3.32	26.52 ± 3.8	0.407
FFI at 2 weeks follow up	12.00 ± 3.39	24.3 ± 2.1	**0.001**
FFI at 6 weeks follow up	11.5 ± 3.1	22.00 ± 3.2	**0.001**

Bold values are significant at $P \leq 0.05$
LSI local steroid injection, *DFM* deep friction massage, *VAS* visual analog scale, *FFI* Foot Function Index

We found that DFM is less effective than local steroid injection for PF at 2 and 6 weeks follow-up. In their study comparing DFM with local steroid injection for treatment of lateral epicondylitis, Yi et al. recently reported a significantly beneficial effect of DFM [12]. Vasseljen recommended the combination of both local steroid injection and DFM for treatment of lateral epicondylitis in their study comparing DFM with several modalities as pulsed ultrasound and laser treatment. He also stated that DFM is more effective than these physical modalities in decreasing pain and increasing the wrist extension strength [20].

On the other hand, Senbursa et al. reported that DFM is more effective in increasing strength and decreasing pain of the supraspinatus tendon in patients with shoulder impingement syndrome when comparing this modality with strengthening exercises in their randomized controlled trial [21]. In a recently published randomized cross-over trial on athletes with patellar tendinopathy, Chaves et al. reported that DFM induces an immediate reduction in pain intensity upon palpation. The authors aimed to assess the immediate analgesic effect of DFM and whether this effect can be influenced by the amount of pressure applied during the sessions. However, this study is strongly limited by the small sample size (ten patients) which needs caution with results interpretation as concluded by the authors [22]. In line with our findings, a pilot study comparing home exercise program with DFM and home exercise program alone for treatment of chronic PF showed an improvement of pain and function in both groups without beneficial effect of the addition of DFM but failed to find a significant difference due to the small sample size (24 patients) [23].

The minimal effect of DFM in treatment of PF may be explained by the difference in the pathogenetic mechanisms between PF, lateral epicondylitis, supraspinatus tendon impingement and patellar tendinopathy, the microstructural difference between the tendon and fascia, and the relatively deeper position of plantar fascia. Nevertheless, more large scaled studies with long-term follow-up are needed to support our results.

Our study has some limitations as the small sample size and the absence of ultrasonographic evaluation before and after treatment as a reliable objective technique used to detect the abnormalities of PF such as the change of echogenicity and the increased thickness of the fascia.

Conclusion

This study revealed that deep friction massage solely is less effective than local steroid injection in decreasing pain and improving function in patients with plantar fasciitis. However, it could be used as an adjuvant modality of physical therapy.

Abbreviations

BMI: Body mass index; DFM: Deep friction massage; FFI: Foot Function Index; LSI: Local steroid injection; PF: Plantar fasciitis; VAS: Visual Analog Scale

Acknowledgements

Not applicable

Authors' contributions

All authors contributed in the design, preparation, data collection, and analysis for this trial and also in the writing and revision. All authors have read and approved the manuscript.

Funding

No funding has been received for this study.

Ethics approval and consent to participate

All participants gave a written informed consent to participate in this study and the ethical committee of the faculty of medicine, Al Azhar University, Assiut, have approved it (No: AUA001005019/09). Date of approval 10 May 2019. This study was approved by the ethical committee of our institution and then retrospectively registered as a clinical trial under the number PACTR202004672785790 on the Pan African Clinical Trial Registry (www.pactr.org). Date 16 April 2020.

Consent for publication

Not applicable.

Competing interests

All the authors declare no financial or non-financial competing interests.

Author details

[1]Department of Rheumatology and Rehabilitation, Faculty of Medicine, Al Azhar University, Al Azhar University Square, Assiut 71524, Egypt. [2]Department of Rheumatology and Rehabilitation, Faculty of Medicine, Sohag University, Sohag, Egypt.

Received: 21 April 2020 Accepted: 18 May 2020
Published online: 03 August 2020

References

1. Riddle DL, Schappert SM (2004) Volume of ambulatory care visits and patterns of care for patients diagnosed with plantar fasciitis: a national study of medical doctors. Foot & Ankle International 25(5):303–310
2. Taunton JE, Ryan MB, Clement DB, McKenzie DC, Lloyd-Smith DR, Zumbo BD (2002) A retrospective case-control analysis of 2002 running injuries. British Journal of Sports Medicine 36(2):95–101
3. Rompe JD. Plantar fasciopathy. Sports Medicine and Arthroscopy Review 2009;17(2):100–4.).
4. Furey JG (1975) Plantar fasciitis. The painful heel syndrome. Journal of Bone and Joint Surgery. American Volume 57(5):672–673
5. Schepsis AA, Leach RE, Gorzyca J (1991) Plantar fasciitis. Etiology, treatment, surgical results, and review of the literature. Clin Orthop. 266:185–196
6. Davis PF, Severud E, Baxter DE (1994) Painful heel syndrome: results of non-operative treatment. Foot Ankle Int. 15:531–535
7. Atkins D, Crawford F, Edwards J, Lambert M (1999) A systematic review of treatments for the painful heel. Rheumatology 38(10):968–973
8. Crawford F, Atkins D, Young P, Edwards J. Steroid injection for heel pain: evidence of short-term effectiveness. A randomized controlled trial. Rheumatology (Oxford, England). 1999;38(10): 974–7.
9. Moshrif A, Elwan M (2019) The effect of addition of buffered dextrose 5% solution on pain occurring during local steroid injection for treatment of plantar fasciitis: a randomized controlled trial. Muscles Ligaments Tendons J. 9(4):525–530
10. Kocaman AA, Yildiz S, Bek N (2017) Plantar fasciitis and current treatment approaches. Clin Surg. 2:1752
11. Kessler R, Hertling D. Friction massage. In: Management of common musculoskeletal disorders, 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 1996:138.
12. Rosemary Yi, Walter W Bratchenko and Virak Tan. Deep friction massage versus steroid injection in the treatment of lateral epicondylitis. Hand 2018; 13 1: 56-59.
13. McPoil TG, Martin RL, Cornwall MW, Wukich DK, Irrgang JJ, Godges JJ (2008) Heel pain - plantar fasciitis: clinical practice guidelines linked to the international classification of function, disability, and health from the Orthopaedic Section of the American Physical Therapy Association. Journal of Orthopaedic and Sports Physical Therapy 38(4):A1–A18
14. Budiman-Mak E, Conrad KJ, Roach KE (1991) The Foot Function Index: a measure of foot pain and disability. J Clin Epidemiol. 44:561–570
15. Cyriax J. Textbook of orthopaedic medicine. Vol 2: treatment by manipulation, massage and injection. Philadelphia: Baillière Tindall; 1984; 2 (19): 119-142.
16. Rivenburgh DW (1992) Physical modalities in the treatment of tendon injuries. Clinics in Sports Medicine 11:645–659
17. Dyck D, Boyajian-O'Neill L (2004) Plantar fasciitis. Clinical Journal of Sports Medicine 14(5):305–309
18. Pfeffer G, Bacchetti P, Deland J et al (1999) Comparison of custom and prefabricated orthoses in the initial treatment of proximal plantar fasciitis. Foot & Ankle International 20:214–221
19. Jha RK, Uprety S, Shah LL (2013) Functional outcome in patients with chronic plantar fasciitis treated with plantar fascia stetching vs tendoachilles stretching exercises. Journal of Institute of Medicine 35(1):32–38
20. Vasseljen O (1992) Low-level laser versus traditional physiotherapy in the treatment of tennis elbow. J Physiother. 78:329–334
21. Senbursa G, Baltaci G, Atay A (2007) Comparison of conservative treatment with and without manual physical therapy for patients with shoulder impingement syndrome: a prospective, randomized clinical trial. Knee Surg Sports Traumatol Arthrosc. 15:915–921. PubMed. https://doi.org/10.1007/s00167-007-0288-x
22. Chaves P, Simões D, Paço M, Silva S, Pinho F, Duarte JA, Ribeiro F (2019) Deep friction massage in the management of patellar tendinopathy in athletes: short term clinical outcomes. J Sport Rehabil. 30:1–6. https://doi.org/10.1123/jsr.2019-0046 [Epub ahead of print]
23. Geoff Formosa & Gordon Smith. Transverse frictional massage for plantar fasciitis: a clinical pilot trial, International Musculoskeletal Medicine. 2011; 33: 3, 107-114, DOI: https://doi.org/10.1179/1753615411Y.0000000008

Publisher's Note