Effectiveness of transverse friction massage of Flexor digitorum brevis and Calf muscle stretching in Plantar fasciitis on foot function index scale: A randomized control trial

Noureen Farooq[1], Saima Aslam[2], Nasir Bashir[3], Waqar Ahmad Awan[4], Madiha Shah[2], Asima Irshad[1]

ABSTRACT

Objective: To compare the effectiveness of transverse friction massage of Flexor digitorum brevis and Calf muscle stretching in Plantar fasciitis on foot function index scale

Study Design: Randomized control trial

Place and Duration: At Isra Institute of Rehabilitation Sciences (IIRS) and National Institute of Rehabilitation Medicine (NIRM) from 28th September 2015 to 10th September 2016.

Methodology: Patients after having diagnosis of Plantar fasciitis were randomly allocated to two groups i.e. group I and group II. Data was collected through self-structured demographic and Foot Function Index (FFI) questionnaires. Other than age, weight, body mass index and calf muscle circumference another variable assessed was Foot Function Index (FFI). Between groups comparison was shown by independent t test and within group comparison was analyzed by repeated measures ANOVA.

Results: Mean age of group I and II patients were 32.4 and 30.3 years respectively. Mean weight and BMI were 66.5, 56.5 and 23.8, 22.8 respectively. Mean FFI of group I and II at baseline was (94.0 ± 24.8) and (115.4 ± 32.9) respectively which was decreased to (36.6 ± 16.0) and (37.8 ± 13.1) after 3 months respectively but between group analysis showed non-significant difference between transverse friction massage and calf muscle stretching. However significant results ($p < 0.05$) were shown within group analysis at different time intervals for foot function index (FFI) of both groups I and II.

Conclusion: Transverse friction massage of Flexor digitorum brevis and Clf muscle stretching are equally effective in treating Plantar fasciitis.

Keywords: Plantar fasciitis, Body mass index, Calf muscle, Calf muscle stretching, Flexor digitorum brevis, Transverse friction massage, Foot function index

How to Cite This:

Farooq N, Aslam S, Bashir N, Awan WA, Shah M, Irshad A. Effectiveness of transverse friction massage of flexor digitorum brevis and calf muscle stretching in plantar fasciitis on foot function index scale: A randomized control trial. Isra Med J. 2019; 11(4)-Part B: 305-309.

1. Assistant Professor of Physiotherapy
2. Senior Lecturer of Physiotherapy

Isra Institute of Rehabilitation Sciences,
Isra University, Islamabad Campus

3. Chief Executive Officer of Media Express Private
4. Associate Professor of Physiotherapy,
Faculty of Rehabilitation and Allied Health Sciences
Riphah International University, Islamabad.

Correspondence:
Noureen Farooq
Assistant Professor of Physiotherapy, Isra Institute of Rehabilitation Sciences (IIRS), Isra University, Islamabad Campus
Email: noureen.15@gmail.com

Received for Publication: September 09, 2019
1st Revision of Manuscript: October 15, 2019
2nd Revision of Manuscript: October 19, 2019
Accepted for Publication: October 24, 2019

INTRODUCTION

Bolgla defines Plantar fasciitis a common overuse injury which occurs as a result of undue forces on plantar fascia and flexor digitorum brevis[1]. In 2014 Michaud confirms that Flexor digitorum brevis works actively and dynamically during propulsive phase of gait while Plantar fascia works passively and supports the Flexor digitorum brevis (FDB)[2]. Due to repetitive trauma or weakness, flexor digitorum brevis thus will be unable to work properly and distribute the stresses placed on them and symptoms of plantar fasciitis produces[3]. Various factors precipitate in causing plantar fasciitis. These include foot deformities, stress fracture, improper foot wears, increased body mass index (BMI), occupational demands like prolong standing, biomechanical abnormalities, myofascial trigger points in foot and calf muscles, limited ankle dorsiflexion due to shortened or tightened gastrocnemius muscle, soleus muscle and Achilles tendon[4]. Pain of plantar fasciitis usually comes up in the morning at time of getting out of bed and taking first step but it decreases as day goes on. Sometimes it becomes severe as the day ends. Excessive

standing and weight bearing aggravates the pain while rest reduces it[5]. Plantar fasciitis can be treated by electro therapeutic modalities which are therapeutic ultrasound, interferential current, shock waves, laser therapy and extra corporal shock wave therapy[6-8]. Ice packs are also used to reduce inflammation associated with plantar fascia[9]. Other conservative methods include stretching and strengthening exercises of foot and calf muscles. Activity modification with proper shoe support to reduce biomechanical factors[10-12]. Myofascial release, ischemic compression, active release technique, cross friction and transverse friction massage is used to provide manual compression with hands and releases the nodes and thus relieves pain and induce relaxation. Joint also comes under consideration to reduce hypomobility and tightened fascia by mobilizing ankle joint, talocrural joint and subtalar joint[13].

Many syndromes caused by repetitive trauma are effectively treated by transverse friction massage. Flexibility of soft tissues is a mainstay in any therapeutic intervention. Stretching exercises specifically static stretching is adopted mostly to maintain length of the connective tissues. Structures responsible for elongation of soft tissue is series elastic and parallel elastic elements of skeletal muscle[14,15].

Foot function index (FFI) is a questionnaire used most commonly for foot and ankle disabilities. It was developed by B. Mak. This index describes effect of pathological conditions of foot and ankle in terms of pain, disability and activity restriction. They are further subdivided into subscales i.e. pain, disability and activity limitation. Subscales are scored from 0 – 10 i.e. 0 indicates no pain and 10 indicates worst pain imaginable[16].

Several interventions have been adopted in the clinical setting for improvement of plantar fasciitis including therapeutic ultrasound, myofascial release, stretching of calf muscles, kinesio taping, strengthening exercises of intrinsic foot muscles, activity modification and orthoses. Surgical intervention may also be done for relieving symptoms of plantar fasciitis. Transverse friction massage is also a treatment protocol advised, only a pilot study has been done on its effectiveness and its use as standard clinical approach. As transverse friction massage is known to increases the blood circulation, breaks down adhesions and relaxes the muscles and fascia. The findings of this research will assist in establishing the effectiveness of this technique, compared to calf muscle stretching. To the best of author's knowledge, no such comparison has been reported yet. Therefore, the study was conducted to compare the effectiveness of transverse friction massage of flexor digitorum brevis and calf muscle stretching in plantar fasciitis on foot function index scale

METHODOLOGY

This randomized control trial was conducted in outpatient clinic of physiotherapy at Al Nafees Medical Hospital, Isra University Islamabad and National Institute of Rehabilitation Medicine (NIRM), Islamabad. Duration of study was from 28 September 2015 to 10th September 2016. Through non probability convenience sampling, a total of 30 patients were included and randomly allocated to group I (control) that includes patients having treatment with calf muscle tendon unit (CMU) stretching exercises and group II (experimental) includes patients undergoing treatment with transverse friction massage of flexor digitorum brevis (FDB). An inclusion criterion for patients were males and females with age range of 25 – 45 years, referred from orthopedic department with diagnosed plantar fasciitis. Patients with complain of pain upon first step after getting out of bed and pain at plantar surface of mid foot similar to plantar fasciitis were included. History of ankle and foot fracture or surgery in previous 6 months, bilateral heel pain and pregnant ladies suffering from plantar fasciitis were excluded from the study. Patients satisfying the inclusion criteria were assigned to each group. One patient was dropped out in group I and 3 patients didn't follow up in group II. Demographic data was collected through self-structured questionnaire about gender, occupation, BMI and calf circumference. Foot function index (FFI) was used most for assessment of pain, disability and activity limitation in patients of plantar fasciitis. Subscales are scored from 0 – 10 i.e. 0 indicates no pain and 10 indicates worst pain imaginable. Sessions planned for each patient will be thrice a week. At 0 day all questionnaires were filled by the patient i.e. demographic data, foot function index (FFI) before session. Data was collected through tools after every 15 days and follow-up was done till 3 months i.e. 0 day, 15th day, 1 month, 1.5 month, 2 months, 2.5 months and 3 months.

Data Analysis: Within group I and II treatment were analyzed at different time intervals in terms of pain, disability and activity limitation index through repeated measures ANOVA. Comparison of calf muscle stretching and transverse friction massage in terms of pain, disability and activity limitation scale was assessed through independent t-test.

RESULTS

Among total of 26 patients, 14 patients were included in group I out of which 6 (42.9%) were male and 8 (57.1%) were female. Mean age of these patients were 32.4 ± 8.2 years, mean weight was 66.5 ± 12.8 kg, and mean BMI was 23.8 ± 3.7 kg/m^2. Group II includes 12 patients out of which 2 (16.7%) were male and 10 (83.3%) were female. Mean age of group 2 patients were 30.3 ± 8.2 years, mean weight was 56.5 ± 8.4 kg and BMI were 22.8 ± 1.9 kg/m^2. No significant difference was seen in age, weight and body mass index of group I and II patients. Right and left calf circumference (37.1 ± 6.6), (37.2 ± 6.4) was measured from day 0 up to 3 months after every 15 days and both groups were compared but no significant difference was seen with p values 0.3 and 0.2 respectively. Within group comparison of calf muscle tendon unit stretching group for plantar fasciitis from base line (0 day) to 3 months on foot function index (FFI) showed significant results within group I at 0 – 2 months (42.4 ± 2.4) to (25.0 ± 0.0) for pain and (94.0 ± 6.6) to (53.7 ± 6.8) for total FFI score, 0 – 3 month (42.4 ± 2.4) to (17.0 ± 0.0) for pain, 1 – 2 month (73.4 ± 7.6) to (53.7 ± 6.8) for total FFI score and from 2 – 3 months (53.7 ± 6.8) to (36.6 ± 4.3) for total FFI score.

Table-I: Comparison for Foot Function Index at different time intervals from baseline to terminal session (3 months) between both groups (N=26)

FFI variables at different time intervals		Control Group		Experimental Group		Significance
		Mean	S.D	Mean	S.D	P Value
0 Day	Pain	42.4	9.0	50.0	10.90	0.08
	Disability	41.0	0.0	41.0	0.0	N.A*
	Activity Limitation	7.0	0.0	7.0	0.0	N.A*
	Total	94.0	24.8	115.4	32.9	0.07
15 days	Pain	37.0	0.0	37.0	0.0	N.A*
	Disability	34.0	0.0	34.0	0.0	N.A*
	Activity Limitation	3.0	0.0	3.0	0.0	N.A*
	Total	83.0	24.8	93.7	32.2	0.4
1 Month	Pain	37.0	0.0	37.0	0.0	N.A*
	Disability	29.0	0.0	29.0	0.0	N.A*
	Activity Limitation	3.0	0.0	3.0	0.0	N.A*
	Total	73.4	28.3	78.8	33.7	0.7
1.5 Month	Pain	31.0	0.0	31.0	0.0	N.A*
	Disability	21.0	0.0	21.0	0.0	N.A*
	Activity Limitation	3.0	0.0	3.0	0.0	N.A*
	Total	60.7	28.9	60.7	28.9	N.A*
2 Months	Pain	25.0	0.0	25.0	0.0	N.A*
	Disability	17.0	0.0	17.0	0.0	N.A*
	Activity Limitation	3.0	0.0	3.0	0.0	N.A*
	Total	53.7	25.5	54.2	23.2	1.0
2.5 Months	Pain	25.0	0.0	25.0	0.0	N.A*
	Disability	18.0	0.0	18.0	0.0	N.A*
	Activity Limitation	3.0	0.0	3.0	0.0	N.A*
	Total	47.6	18.4	45.3	18.4	0.8
3 Months	Pain	17.0	0.0	17.0	0.0	N.A*
	Disability	14.0	0.0	14.0	0.0	N.A*
	Activity Limitation	3.0	0.0	3.0	0.0	N.A*
	Total	36.6	16.0	37.8	13.1	0.8

N.A* is not applicable

Group II having transverse friction massage of FDB showed significant difference within 0-1 month (50.0 ± 3.6) to (37.0 ± 0.0) in terms of pain and total foot function index, 0-2 month (50.0 ± 3.6) to (25.0 ± 0.0) for pain, 0-3 month (50.0 ± 3.6) to (17.0 ± 0.0) for pain and (115.4 ± 9.5) to (37.8 ± 3.8) for total FFI score, 1-2 month (78.8 ± 9.7) to (54.2 ± 6.7) for total FFI score.

Table-I shows between- group comparison for Foot Function Index (FFI) at different time intervals from 0 day to 3 months. Mean FFI at base line for CMU stretching group is (94.0 ± 24.8) which reduces to (36.6 ± 16.0). Baseline mean FFI for TFM group was (115.4 ± 32.9) to (37.8 ± 13.1) at terminal session. Non-significant difference was seen between group calf muscle tendon unit stretching and transverse friction massage of flexor digitorum brevis on foot function index from base line to terminal session.

DISCUSSION

Plantar fasciitis is the condition caused by the excessive stress and traction forces on the plantar fascia and flexor digitorum brevis (FDB) which when fails to distribute the loads ultimately evolves into pain in foot while standing, stepping out of bed and functional changes of gait[17]. Various factors or underlying conditions are associated with plantar fasciitis. These factors include increase in body mass index, occupation involving prolonged standing, repetitive micro trauma and several medical conditions like diabetes mellitus[18].

Current study found out effects of transverse friction massage (TFM) of flexor digitorum brevis (FDB) in group I and stretching exercises of calf muscle tendon unit in group II. Both treatment regimens showed non-significant outcomes i.e. $p > 0.05$ on foot function index (FFI) scale but improvement was seen in terms of means as total FFI score was reduced.

A pervious study was conducted by Hassan et al studied about The Effect of Deep Friction Massage versus Stretching of Wrist Extensor Muscles in the treatment of tennis elbow. 40 patients were distributed in II groups. First group contain deep friction massage and II group contain stretching exercises, ultrasound therapy was also given for 6 weeks (3 sessions per week). So it resulted that stretching exercise had good effect as compared to transverse friction massage[19]. Transverse friction massage still needs more work in clinical studies to find out its effectiveness in musculoskeletal disorders. Different aspects in

treatment like intensity, frequency, duration and mode of transverse friction massage should be taken under consideration for better results.

Between group comparison was shown for right and calf circumferences in current study. No significant difference was seen in left calf circumference from 0 day to 3 month in group I and II. Similarly no significant difference was seen in right calf circumference between the two groups and also within the group after every 15 days. Both the treatment protocols stretching exercises of calf muscle tendon unit and transverse friction massage showed no effect on calf circumference. Previous study done by Wokhlu et al about clinical correlation of tight tendo-achilles with plantar fasciitis resulted that in planter fasciitis the flexibility and strength deficits in musculature of calf muscles on affected side noticed[20].

Jan et al did a study on specific stretching versus radial shock wave therapy for treatment of plantar fasciitis. Foot function index sum score showed significant difference[21]. Baldassin and colleagues studied effectiveness of pre-fabricated and customized foot orthoses made from low cost foam for non-complicated plantar fasciitis. Outcome measures were pain and modified FFI. Significant improvement was seen in pain and FFI i.e. < 0.05 initially till 4 weeks. After that intra group differences were seen but no inter group difference was seen from 4 to 8 weeks[22]. A pilot study was conducted to compare radial and focused extra corporeal shock waves in plantar fasciitis by Lohrer et al using foot function index FFI. Significant results were seen for focused extracorporeal shock waves[23]. Kumnerddee and co-worker conducted study to compare efficacy of electro puncture with conventional treatment and conventional treatment alone. Conventional group receives stretching exercises, shoe modification and analgesics for 5 weeks. Experimental group was given electro-acupuncture sessions twice weekly. FFI decreased significantly only in experimental group[24]. Current study shows between-group comparison for Foot Function Index after every 15 days from 0 day to 3 month. Overall no significant difference was seen between group I and II at baseline level. At 15 day pain, disability and activity limitation scale of both groups were same but mean difference of all scales decreases between 0 day and 15 day. Total FFI scale score was also decreased but no significant difference was seen between two groups. After wards although mean of FFI at 1, 1.5, 2, 2.5 and 3 months was decreased in both groups but no significant difference was seen.

This study was conducted to evaluate the effects of transverse friction massage of flexor digitorum brevis and to compare them with those of calf muscle tendon unit stretching exercises in plantar fasciitis. The effects of transverse friction massage of flexor digitorum brevis and calf MTU stretching exercises showed significant results. Comparison between the effects of calf MTU stretching exercises and transverse friction massage did not show significant results.

CONCLUSION

Transverse friction massage of Flexor digitorum brevis and calf muscle stretching are equally effective in treating Plantar fasciitis.

CONTRIBUTION OF AUTHORS

Noureen F: Conceived idea, Designed research methodology, Data collection, Manuscript writing
Saima A: Data collection, Manuscript writing
Nasir B: Statistical analysis
Waqar A: Designed research methodology, Critical revision
Madiha S: Data collection and analysis
Asima I: Critical revision

Disclaimer: None.
Conflict of Interest: None.
Source of Funding: None.

REFERENCES

1. Hsiao MY, Hung CY, Chang KV, Chien KL, Tu YK, Wang TG. Comparative effectiveness of autologous blood-derived products, shock-wave therapy and corticosteroids for treatment of plantar fasciitis: a network meta-analysis. Rheumatol 2015 ;54(9): 1735-1743.
2. Thomas Michaud. Differential Diagnosis of Heel Pain Dynamic Chiropractic. 2013; 31(02): 1-2.
3. Thing J, Maruthappu M, Rogers J. Diagnosis and management of plantar fasciitis in primary care. Br J Gen Pract 2012; 62: 443–444.
4. Waclawski ER, Beach J, Milne A, Yacyshyn E, Dryden DM. Systematic review: plantar fasciitis and prolonged weight bearing. J Occup Med. 2015; 65(2): 97-106.
5. Lim AT, How CH, Tan B. Management of plantar fasciitis in the outpatient setting. Saudi Med J. 2016; 57(4): 168.
6. Sherpy NA, Hammad MA, Hagrass HA, Samir H, Abu-El-Maaty SE, Mortada MA. Local injection of autologous platelet rich plasma compared to corticosteroid treatment of chronic plantar fasciitis patients: a clinical and ultrasonographic follow-up study. The Egyptian Rheumatol 2016; 38(3): 247-252.
7. Mardani-Kivi M, Mobarakeh MK, Hassanzadeh Z, Mirbolook A, Asadi K, Ettehad H et al. Treatment outcomes of corticosteroid injection and extracorporeal shock wave therapy as two primary therapeutic methods for acute plantar fasciitis: a prospective randomized clinical trial. J Foot Ankle Surg. 2015; 54(6): 1047-1052.
8. Konjen N, Napnark T, Janchai S. A comparison of the effectiveness of radial extracorporeal shock wave therapy and ultrasound therapy in the treatment of chronic plantar fasciitis: a randomized controlled trial. J Med Assoc Thai. 2015; 98(1): 49-56.
9. Podolsky R, Kalichman L. Taping for plantar fasciitis. J Back Musculoskelet Rehabi2015; 28(1): 1-6.
10. Petraglia F, Ramazzina I, Costantino C. Plantar fasciitis in athletes: diagnostic and treatment strategies. A systematic review. Muscles Ligaments Tendons J 2017; 7(1): 107.
11. Sullivan J, Burns J, Adams R, Pappas E, Crosbie J. Musculoskeletal and activity-related factors associated

with plantar heel pain. J Foot Ankle Int. 2015; 36(1): 37-45.
12. Kamonseki DH, Gonçalves GA, Liu CY, Júnior IL. Effect of stretching with and without muscle strengthening exercises for the foot and hip in patients with plantar fasciitis: A randomized controlled single-blind clinical trial. J Man Therap 2016; 23: 76-82.
13. Fraser JJ, Corbett R, Donner C, Hertel J. Does manual therapy improve pain and function in patients with plantar fasciitis? A systematic review. J Man Manip Ther. 2018; 26(2): 55-65
14. Celik D, Kuş G, Sırma SÖ. Joint mobilization and stretching exercise versus steroid injection in the treatment of plantar fasciitis: a randomized controlled study. Foot Ankle Int. 2016; 37(2): 150-156.
15. Rasal TC, Jeswani K. The effect of Cyriax (Transverse frictional massage) on pain and function in patients with plantar fasciitis randomized controlled trial study. Int J of Appli Res. 2018; 4(5): 27-35.
16. Pourtier-Piotte C, Pereira B, Soubrier M, Thomas E, Gerbaud L, Coudeyre E. French validation of the Foot Function Index (FFI). Ann Phys Rehab Med. 2015; 58(5): 276-282.
17. Maria J, Greve A, Grecco M, Silva P. Comparison of radial shockwaves and conventional physiotherapy for treating plantar fasciitis. Clinics. 2009; 64: 97-103.
18. McNally E, Shetty S. Plantar Fascia: Imaging Diagnosis and Guided Treatment. Semin Musculoskelet Radiol 2010; 14(3): 334-343.
19. Hassan S, Hafez A, Seif H, Kachanathu S. The Effect of Deep Friction Massage versus Stretching of Wrist Extensor Muscles in the Treatment of Patients with Tennis Elbow. Open J of Ther and Rehab 2016; 4: 48-54.
20. Wokhlu A, Rai J, Gill SS. The clinical correlation of tight tendoachilles with plantar fasciitis. Indian J Ortho 2002; 36(1): 49.
21. Rompe J, Cacchio A, Weil L, Furia J, Haist J, Reiners V, et al. Plantar fascia specific stretching versus radial shock wave therapy as initial treatment of plantar fasciopathy. J Joint Bone Surg 2010; 92: 2514-2522.
22. Baldassin V, Gomes C, Beraldo P. Effectiveness of Prefabricated and Customized Foot Orthoses Made From Low-Cost Foam for Noncomplicated Plantar Fasciitis: A Randomized Controlled Trial. Arch Phys Med Rehab 2009; 90(4): 701-706.
23. Lohrer H, Nauck T, Dorn-Lange N, Schöll J, Vester J. Comparison of Radial Versus Focused Extracorporeal Shock Waves in Plantar Fasciitis Using Functional Measures. J Foot Ankle Int 2010; 31(1): 1.
24. Kumnerddee W, Pattapong N. Efficacy of electro-acupuncture in chronic plantar fasciitis: a randomized controlled trial. Am J Chin Med 2012; 40(06): 1167-1176.