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Original Research Article

Efficacy of Muscle Energy Technique as Compared to Myofascial Trigger Point Release in Chronic Plantar Fasciitis: A Double Blind Randomized Clinical Trial

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ABSTRACT

Background and Purpose: Plantar fasciitis is most common cause for plantar foot pain and affects both male and female. Previous studies have reported that MTrP release along with stretching of the calf muscle and the plantar fascia are effective management strategies for plantar heel pain. This study was designed to evaluate the effect of two different techniques i.e. Muscle Energy Technique (MET) and Myofascial Trigger Point (MTrP) release in subjects with chronic plantar fasciitis.
Methods: 45 subjects of chronic plantar fasciitis were included and randomly assigned in to three different groups. Group-A received 12 sessions of MET along with self stretching, Group-B received 12 sessions of MTrP release along with self stretching and Group-C received 12 sessions of self stretching program for 4 weeks. Self stretching of calf and plantar fascia were given as supervised, as well as home exercise program for all three groups.
Outcome measures: Pain intensity was measured by VAS; Tenderness was assessed by PPT at MTrP of calf (PPT-Calf) and at medial calcaneal tubercle of heel (PPT-Heel) and functional status was evaluated by FFI scale at base line and at the end of fourth week.
Result: Statistically significant improvement ($p<0.05$) was noticed in all the three groups for all the outcomes. In between group comparison all the outcomes showed statistically significant changes except FFI score in favor of Group-B than Group-A and Group-C.
Conclusion: The present study showed that MTrP release is more effective than MET in alleviation of pain & tenderness in subjects with chronic plantar fasciitis.
Key Words: Plantar fasciitis, Muscle energy technique (MET), Myofascial trigger point (MTrP) release, Pressure Pain Threshold (PPT), Foot Function Index (FFI).

INTRODUCTION

"Plantar fasciitis" is used to describe a painful heel with inflammation of the plantar fascia at its origin, as opposed to pain originating along the course of the fascia, caused by repeated trauma to plantar fascia at its origin on the under surface of calcaneum. [1,2] Plantar fasciitis affects active and sedentary adults of any age and more likely to occur in persons who spend most of the day on their feet or who have limited ankle dorsiflexion. [3,4] It is more common in women and affects up to 10% of general population, accounting for 11 to 15% of all foot pathologies. [5-7] Matheson et al (1989) reported that prevalence of plantar fasciitis increases with increase in age. [8]

Plantar fasciitis is widely described in the literature as having a multi-factorial and widely disputed etiology but this inflammatory response has been uniformly classified as an overuse syndrome, resulting

from micro-tear of the plantar fascia at its origin. [2,9-11]

Riddle DL et at (2003) observed that individuals with a body mass index (BMl) >30 kg/m^2 had an odds ratio of 5.6 for plantar fasciitis compared to those with a BMI <25 kg/m^2. They observed that risk of plantar fasciitis increases as the range of ankle dorsiflexion decreases. [12] Grieve R et al (2011) suggested that myofascial trigger point in calf muscle can leads to reduce or limited dorsiflexion of ankle joint, which can further increase the risk of plantar fasciitis. [13]

Subjects initially present with a typical complain of heel pain during the first few steps in the morning and after prolonged rest. [3] The discomfort is severe on weight bearing immediately after one wakes up in the morning but often improves after walking for a while. [10]

Numerous conservative treatments have been used to relieve the symptoms associated with plantar fasciitis such as drug therapy, exercises, external support and modalities. Among these, stretching of the gastrocnemius muscle and the plantar fascia have shown moderate evidence of effectiveness, but only the short term effects have been concluded. [3,14]

Simon DG (2002) have recommended that taut bands myofascial/ muscle trigger points hereafter referred as, MTrP in the calf muscle increase the stiffness and may reduce the dorsiflexion range of ankle joint, [15] which is one of the risk factor of plantar fasciitis. [1]

Muscle Energy Technique (MET) is used in various musculoskeletal disorders for variety of purposes like lengthening of shortened structure, increasing range of motion, resolving trigger point. MET commonly utilizes isometric contraction of muscle for a brief period, which influences the Golgi tendon organs and causes post-isometric relaxation. [16]

Previous literatures, Clinical practice guidelines and Cochrane reviews show conflicting evidences for proper physiotherapeutic management of plantar fasciitis, even the most commonly used technique such as stretching has moderate evidence of effectiveness. MET and MTrP release are effective treatment technique in resolving trigger point, but there is lack of evidence that can evaluate the effect of MET on calf muscle MTrP to treat plantar fasciitis and also there is lack of comparative study between MET and MTrP release. Therefore, this study tried to investigate the effects of MET and MTrP in subjects with chronic plantar fasciitis and compare their effectiveness in addition to self stretching protocol in the treatment of chronic plantar fasciitis.

MATERIALS AND METHODS

Fifty subjects of 20-68 years with a diagnosis of chronic plantar fasciitis of ≥6 months duration were approached and screened for this study. After screening, forty five subjects were recruited. Three subjects were excluded because of not meeting inclusion criteria (n=3) and two subjects unwilling to participate (n=2) (Figure -1). Inclusion criteria's were plantar heel pain with first few steps upon walking (3 to 7cm on a 10 cm VAS scale), Pain located at the heel or plantar surface of foot consistent with plantar fasciitis, with at least one identifiable MTrP within the calf muscle and with Body Mass Index – 18 to 29.9. Following exclusion criteria's were set - Red flags to manual therapy (i.e. tumor, rheumatoid arthritis, osteoporosis, severe vascular disease, etc), previous surgery of foot and ankle complex, any treatment for plantar fasciitis in the previous four weeks, history of foot and ankle trauma/fracture in last six months, deformity of foot and ankle complex and subjects with referred pain due to sciatica and other neurological disorder.

RANDOMIZATION:

Approval of the Institutional Ethical Committee (IEC) was taken before the commencement of the study. Subjects were allocated to three treatment groups- Group A (MET), Group B (MTrP Release) and Group C (control) using computer generated random numbers (BS). Baseline data for

pain intensity on Visual Analogue Scale (VAS) with first few steps on walking, Pressure pain threshold (tenderness) over the medial calcaneal tuberosity of the involved heel (PPT-Heel) and over MTrP on involved Calf muscle (PPT-Calf) by an algometer and function by foot function index (FFI) was recorded. Then therapeutic interventions were delivered by two equally qualified therapists (BS, PS) according to the group allocation. The treating therapist (BS, PS) and subjects were blinded about the group allocation and treatment techniques. A soft heel pad duly prescribed by the physician was given to all subjects and were advised to use it in regular foot-wear during weight bearing activity such as walking/standing throughout their course of treatment. After completing the therapeutic session of four weeks, post-intervention data of outcome measures were again recorded (AM) (Figure-1).

For recoding pain intensity the subjects were instructed to make a mark on the 10 cm horizontal line which best indicates their perceived level of pain with first few steps on walking and then the line was measured from the left end of the 10 cm line and recorded in centimeters [17] Pressure Pain Threshold (PPT) is the minimal pressure when the sense of pressure changes into pain sensation [18] and was assessed with a mechanical pressure algometer over the medial calcaneal tuberosity of calcaneus (PPT-Heel) and over MTrP of calf muscle (PPT-Calf). [19] For measuring PPT at heel and calf region subjects were positioned in prone lying with legs fully extended over the couch and foot placed out of the couch. [16,18] The therapist palpated and marked the tender points over the plantar fascia at the medial calcaneal tuberosity and at MTrP in the calf muscle of the involved limb and applied perpendicular pressure over those areas at a rate of approximately 0.1 kg/c^{m2}/sec. Mean of three trials was calculated. Subjects were explained about the FFI and are requested to mark the FFI questionnaire twice – at pre intervention and post intervention at the end of 4^{th} week.

INTERVENTIONS:

Subjects (n=15) in Group A were treated with MET and supervised self stretching. MET was applied with subject's in supine position and foot extended over the edge of the couch keeping the knee in full extension for gastrocnemius (Figure 2) and knee in slightly flexed position for soleus muscle (Figure 3). The therapist was in walk standing position on the affected side. Subject's ankle joint was dorsiflexed by the therapist's hand until a resistance or discomfort was felt. This position was held and subject was asked to exert effort (isometric contraction using approximately 20% of force) towards plantar flexion for a period of 5 to 7 seconds with appropriate breathing, then resistance was slowly released and relaxation for a period of 5 seconds was given, during this relaxation period, ankle was passively dorsiflexed to a new barrier. [17] A set of 5 repetitions were given for each treatment session for gastrocnemius and soleus muscle separately. This technique was applied three sessions per week for four weeks. [19] Self stretching exercise for calf muscle and plantar fascia were given as supervised as well as home exercise program. Self stretching exercises were instructed to do two times per day, using intermittent stretch of 20 seconds and 20 seconds of rest period, total exercise was of 3 minutes for each stretch (3 minutes for gastrocnemius, 3 minutes for soleus and 3 minutes for plantar fascia). [16]

Subjects in Group B (n=15) were treated with MTrP release for calf (Figure 4, 5) and self stretching exercise. Subjects were positioned in prone lying with legs fully extended, foot placed out of the couch and instructed be in maximum relaxed state. The therapist was in stride standing position on the affected side. A vertical downward pressure was applied by therapist's thumb over MTrP until an increase in muscle resistance (tissue barrier) was perceived. The pressure was maintained until the release of the taut band. Then the pressure was increased and returned to previous level of MTrP tension. A single set of was for 90

seconds, 3 repetitions with 30 seconds gap between every set, were given for each MTrPs. Then the subjects received three longitudinal strokes with moderate pressure (caudal to cranial) by moving the therapists thumb which was placed over the taut band. Three sessions per week for four weeks were given. [16]

Subjects in Group C (n=15) were treated with self stretching as supervised & home exercise. Supervised exercise sessions were done three days per week for four weeks. A handout was given to all the subjects for home based self stretching exercise program.

RESULTS

Statistical analysis was carried out using SPSS 20.0 software (SPSS Inc., Chicago, IL, USA). Demographic data (age, duration of symptoms and BMI score) of forty five subjects (Female=27 and Male=18) were measured using "One-way ANOVA" and was found to be statistically insignificant between the three groups ($p>0.05$) (Table -1) at baseline.

Table - 1: Demographic & Baseline Data

VARIABLES	Group-A (Mean±SD)	Group-B (Mean±SD)	Group-C (Mean±SD)	One-way ANOVA	
				F-value	p-value
	Demographic Data				
AGE	40.8±10.73	37.47±11.82	41.06±6.19	0.62	0.54
DURATION	8.53±2.13	8.27±2.15	9.07±2.46	0.49	0.62
BMI	23.68±3.10	23.76±2.75	23.8±3.10	0.006	0.99
	Baseline Data				
VAS	5.7±0.75	5.57±0.70	5.46±0.89	0.35	0.70
PPT-HEEL	3.30±0.19	3.49±0.48	3.59±0.49	1.87	1.66
PPT-CALF	3.72±0.69	3.70±0.65	3.82±0.50	0.14	0.86
FFI	29.58±7.33	28.89±5.50	29.12±9.89	0.03	0.97

Table - 2: Within group comparison of all outcome parameters

		Group-A	Group-B	Group-C
VAS_Pre (Mean ± SD)		5.70±0.75	5.56± 0.70	5.46± 0.88
VAS_Post (Mean ± SD)		3.17± 0.99	2.04±0.72	3.80±0.78
VAS_Diff (VAS_Pre - VAS_Post) (Mean ± SD)		2.53±0.74	3.52±0.86	1.66±0.85
Paired sample t-test	t-value	13.22	15.750	7.48
	p-value	0.00	0.00	0.00
PPT-Heel_Pre (Mean ± SD)		3.30±0.19	3.5±0.48	3.6±0.49
PPT-Heel_Post (Mean ± SD)		4.59±0.74	5.3±0.66	4.25±0.62
PPT-Heel_Diff (PPT-Heel_Pre – PPT-Heel_Post) (Mean±SD)		1.29±0.66	1.80±0.49	0.65±0.42
Paired sample t-test	t-value	7.46	14.01	5.93
	p-value	0.00	0.00	0.00
PPT-Calf_Pre (Mean ± SD)		3.72 ±0.69	3.70 ±0.65	3.82 ±0.50
PPT-Calf_Post (Mean ± SD)		4.69 ±0.65	5.6 ±0.56	4.3 ±0.60
PPT-Calf_Diff (PPT-Calf_Pre – PPT-Calf_Post) (Mean±SD)		0.97±0.40	1.9±0.67	0.48±0.41
Paired sample t-test	t-value	9.29	10.92	4.44
	p-value	0.00	0.00	0.001
FFI_Pre (Mean ± SD)		29.59±7.33	28.89±5.50	29.12±9.89
FFI_Post (Mean ± SD)		13.99±4.70	9.09±4.17	20.25±7.23
FFI_Diff (FFI_Pre –FFI_Post) (Mean±SD)		15.6±6.22	19.8±7.53	8.87±5.94
Paired sample t-test	t-value	9.69	10.18	5.78
	p-value	0.00	0.00	0.00

Table - 3: Multiple comparisons of all outcome parameters

	Multiple comparison (Post Hoc-Tukey test)					
	Group-A vs. Group-C		**Group-B vs. Group-C**		**Group-A vs. Group-B**	
	Diff	**p**	**Diff**	**p**	**Diff**	**p**
VAS_Diff SCORE	0.87	0.017	1.86	0.00	0.99	0.005
PPT-Heel_Diff SCORE	0.64	0.008	1.15	0.00	0.51	0.03
PPT-Calf_Diff SCORE	0.49	0.032	1.42	0.00	0.93	0.00
FFI_Diff SCORE	6.73	0.021	10.93	0.00	4.20	0.201

Test of normality was done using "Shapiro-Wilk" test which revealed that data was normally distributed ($p>0.05$), thus parametric test were used for analysis of these continuous data. "Paired sample t-test" were used to see the differences within the group at baseline and after the completion of treatment protocol. "One-way ANOVA" and Post-Hoc Tukey test for multiple comparisons were used to see the differences between the groups.

Within group analysis of all outcome parameters has shown statistically significant difference between pre and post intervention data ($p<0.05$) in all the three groups. The mean improvement of VAS scores in Group-A was 2.53±0.74; Group-B was 3.52±0.86 and in Group-C was 1.66±0.85. PPT-Heel scores mean improvement in Group-A was 1.29±0.66; Group-B was 1.80±0.49 and in Group-C was 0.65±0.42. The mean improvement of PPT-calf scores in Group-A was 0.97±0.40; Group-B was 1.9±0.67 and in Group-C was 0.48±0.41. And mean improvement of FFI scores in Group-A was 15.6±6.22; Group-B was 19.8±7.53 and in Group-C was 8.87±5.94 (Table-2). In all these three parameters Group-B has shown more improvement than the other two groups and both Group-A & B have shown more improvement with respect to Group-C (Table-2).

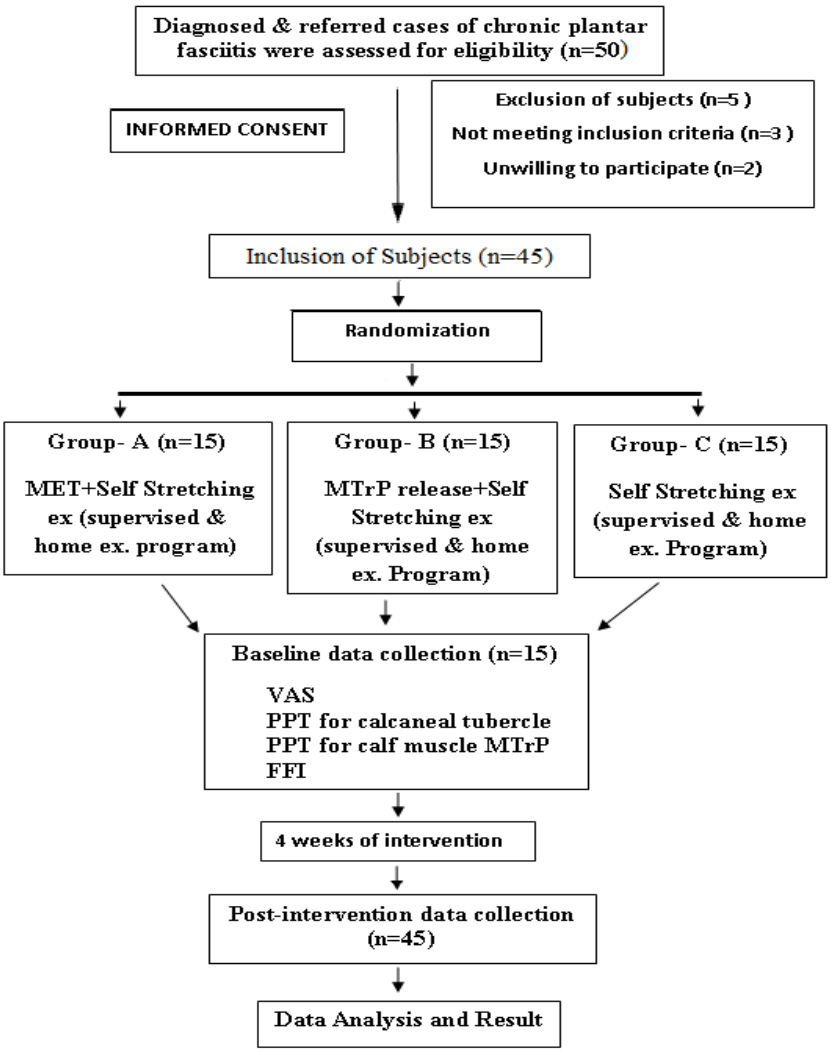

Figure 1: Consort Flow Diagram

Comparison of mean difference of VAS_Pre and VAS_Post (VAS_Diff) was found to be statistically significant between Group A vs. C (p=0.017), Group B vs. C (0.0) and Group A vs. B (p=0.005) (Table 3). Between group comparison of PPT-Heel scores (PPT-Heel_Diff) was found to be statistically significant in Group A vs. C (p=0.008), Group B vs. C (0.0) and Group A vs. B (p=0.03) (Table 3). Comparison of PPT-Calf score (PPT-Calf_Diff) was found to be statistically significant between Group A vs. C (p=0.032), Group B vs. C (0.0) and Group A vs. B (p=0.00) (Table 3).

The mean difference of FFI_Pre and FFI_Post (FFI_Diff) was found to be statistically significant between Group A vs. C (p=0.021), Group B vs. C (0.0) and Group A vs. B (p=0.201) (Table 3). Group-A & Group-B have shown statistically significant improvement with respect to Group-C, whereas Group-A and Group-B comparison shown statistically insignificant difference in FFI_Diff scores (Table 3).

Figure 2: MET for Gastrocnemius

Figure 3: MET for Soleus

Figure 4: MTrP Release over the Calf muscle

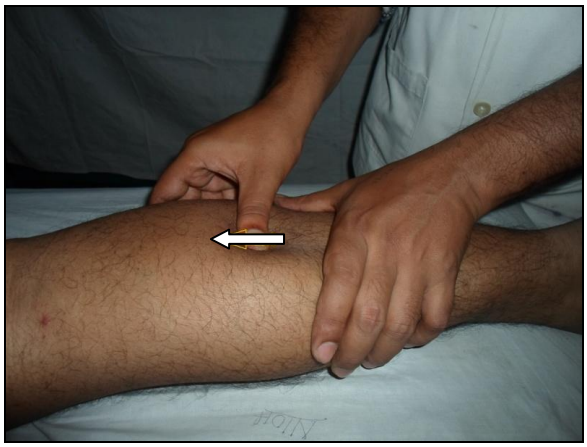

Figure 5: Longitudinal stroke

DISCUSSION

The current study tried to compare the effectiveness of MET and MTrP release on pain and function as a manual therapy approach in addition to self stretching exercise in the treatment of chronic plantar fasciitis.

Pain intensity measured on VAS revealed significant reduction in all the three groups and among these Group B subjects showed more reduction. The mechanisms underlying therapeutic action of MET may involve a variety of neurophysiological, biomechanical mechanisms and changes in tissue fluid. [20] MET commonly utilizes isometric contraction of muscle for a brief period, an increased tension maintained for a few seconds is sensed within the Golgi tendon organs, which transmit impulses to the posterior horn cell and has an inhibitory effect on the increased motor stimulus at the anterior horn cell. This inhibitory effect causes a reduction in motor impulses and

consequent relaxation (autogenic inhibition) which improved the resting length of hyperactive muscle. [18,21] MET can release articular restrictions, lengthen muscle fibers and increase the range of motion through a combination of creep and plastic change in the connective tissue. [20] McPartland JM et al (2005) stated that osteopathic manipulative treatment such as MET, trigger point release etc releases endogenous cannabinoids (anandamide and 2-arachidonoylglycerol) which binds to cannabinoid receptors in the brain and produces reduction in pain perception. [22]

On the other hand MTrP release produces an extra physiological effect i.e. it causes reactive hyperemia within the trigger point. [16] Simon DG (2002) while describing the pathogenesis of MTrP stated that acute or chronic muscle overload initiates the excessive release of acetylcholine, which produces the local energy crisis that can account for the clinical characteristics of MTrPs. [15] Increased blood flow to the trigger point may breaks the local energy crisis and resolve the trigger point. Direct pressure on sarcomeres in MTrP release produces relaxation of involved muscle, may equalize or increase the length of the sarcomeres which can increasing ROM and reduce muscle tension and consequently decrease the pain and tenderness. [16] More reduction in tension of taut band in calf muscle may cause more reduction in excessive tensile loads over the plantar fascia. [22] MTrP release also produces reactive hyperemia within the trigger point and relief of muscle tension by a spinal reflex mechanism, produce improvement in pressure tolerance at MTrP. [13,16] This was further established by Renan-ordine R et al (2011) that compression over MTrP of calf muscle by direct pressure combined with stretching of the involved muscle may normalize the length of sarcomeres and reduces the excessive stress force over the plantar fascia. [18]

In chronic stage of plantar fasciitis there are fibrotic changes in plantar fascia [13] and stretching of plantar fascia might have increased its elasticity. [23] Stretching can correct the functional risk factors, such as tightness of the Achilles tendon and fibrotic changes of plantar fascia in chronic plantar fasciitis. [1] Collectively MET and self stretching program might have reduced the tightness of calf muscle and thus excessive load on plantar fascia. [1,23,24] Calf stretching might also produced relaxation of contracted muscle fibers at trigger point. [22] Neb M et al (2014) found a positive correlation between foot pain and disability by using FFI scale. [25] FFI scale consists of total 23 questions that are divided into three subscales- pain subscale, disability subscale and activities limitation subscale. [26,27] Reduction in FFI scores were found in all the three groups and reduction in pain intensity might have improved functional activity and ability.

Corroborating the findings of all the outcome parameters it was observed that the addition of MTrP release with self stretching protocol result in superior outcome as compared to MET and self stretching alone in the treatment of chronic plantar fasciitis. The result of this study also supports the use of therapeutic intervention in the form of MET and MTrP release in the management of plantar fasciitis.

LIMITATIONS:

The result of the present study needs to be viewed in light of several limitations such as small sample size, without follow up and absence of sham or placebo group. A double-blind, multicentre randomized controlled trial with more number of subjects and long term follow up may be conducted in future to assess and compare the effect of these manual therapy techniques to improve the validity of result.

CONCLUSION

This study showed that Muscle Energy Technique and Myofascial Trigger Point release along with stretching exercises are effective in reducing pain, improving

pressure tolerance and improving function in subjects with chronic plantar fasciitis.

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REFERENCES

1. Roxas M. Plantar fasciitis: diagnosis and therapeutic consideration. Altern Med Rev 2005;10(2):83-93.
2. Cornwall MW, McPoil TG. Plantar fasciitis: etiology and treatment. J Orthop Sports Phys Ther l999;29:756-760.
3. Cole C, Seto C, Gazewood J. Plantar fasciitis: evidence-based review of diagnosis and therapy. Am Fam Physician 2005;72 (11):2237-2242.
4. Ebrahim AH, Ahmed GM, Elsayed E, Sarhan R. Effect of electro acupuncture TENS, stretching exercises and prefabricated insole in patients with plantar fasciitis. Altern Med Rev 2002;10.
5. Buchbinder R. Plantar fasciitis. N Engl J Med 2004;350:2159-66.
6. McCarthy DJ, Gorecki GE. The anatomical basis of inferior calcaneal lesions: a cryomicrotomy study. J Am Podiatry Assoc 1979;69:527-536.
7. Beyzadeoglu T, Gokce A, Bekler H. The effectiveness of dorsiflexion night splint added to conservative treatment for plantar fasciitis. Acta Orthop Traumatol Turc 2007;41(3):220-224
8. Matheson GO, Macintyre JG, Taunton JE. Musculoskeletal injuries associated with physical activities in older adults. Med Sci Sports Exerc 1989;21(4):379-385.
9. Hyland MR, Webber-Gaffney A, Cohen L, Litchman SW. Randomized controlled trial of calcaneal taping, sham taping, and plantar fascia stretching for the short-term management of plantar heel pain. J Orthop Sports Phys Ther 2006;36(6):364-371.
10. Crosby W, Humle RN. Rehabilitation or plantar fasciitis. Clin Podiatr Med Surg 2001;18:225-231.
11. Lemont H, Ammirati KM, Usen N. Plantar fasciitis: a degenerative process (fasciosis) without inflammation. J Am Podiatr Med Assoc 2003;93(3):234-237.
12. Riddle DL, Pulisie M. Pideoe P. Johnson RE. Risk factors for plantar fasciitis: a matched case-control study. J Bone Joint Surg Am 2003;85:872-877.
13. Grieve R, Clark J, Pearson E, Bullock S, Boyer C, Jarrett A. The immediate effect of soleus trigger point pressure release on restricted ankle joint dorsiflexion: a pilot randomized controlled trial. J Bodywork Mov Ther 2011;15:42-49.
14. Young CC, Rutherford DS. Niedfeldt MW. Treatment of plantar fasciitis. Am Fam Physician 2001;63:467-474.
15. Simons DG. Understanding effective treatments of myofascial trigger points. J Bodywork Mov Ther 2002;6:81-88. 15
16. Chaitow L. Muscle energy technique. 3rd ed. Edinburgh. Churchill Livingstone Elsevier; 2008. p. 143, 254.
17. Boonstra AM, Schiphors-Preuper HR, REneman MF. Reliability and validity of the visual analogue scale for disability in patients with chronic musculoskeletal pain. Int J Rehabil Res 2008;31:165-9.
18. Renan-ordine R, Alburquerque-sendin F, De Souza DP, Cleland JA, Fernandez-de-Las-Penas C. Effectiveness of myofascial trigger point manual therapy combined with a self-stretching protocol for the management of plantar heel pain: a randomized controlled trial. J Orthop Sports Phys Ther 2011;41:43-50.
19. Fischer AA. Reliability and usefulness of the pressure pain threshold in patients with myofascial pain. J. Musculoskelet Pain 1998;6(1):5-32.
20. Kucuksen S, Yilmaz H, salli A, Ugurlu H. Muscle energy technique versus corticosteroid injection for management of chronic lateral epicondylitis: randomized controlled trial with 1-year follow-up. American Congress of Rehabilitation Medicine 2013;94:2068-2074.
21. Shenouda MM. Efficacy of stretching exercises versus post-isometric relaxation technique on pain, functional disability and range of motion in patients with cervical spondylosis. a randomized controlled trial. Bull. Fac. Ph. Th. Cairo Univ 2012;17(2): 73-79.

22. McPartland JM, Giuffrida A, King J, Skinne E, Scotter J, Richard E. Musty RE. Cannabimimetic effects of osteopathic manipulative treatment. J Am Osteopath Assoc. 2005 Jun;105(6):283-91.
23. Digiovanni BF, Nawoczenski DA, Malay DP, Graci PA, Williams TT, Wilding GE, Baumhauer JF. Plantar fascia-specific stretching exercise improves outcomes in patients with chronic plantar fasciitis: a prospective clinical trial with two-year follow-up. J Bone Joint Surg 2006;88:1775-1781
24. Wolgin M. Cook C. Graham C, Mauldin D. Conservative treatment of plantar heel pain: long-term follow-up. Foot Ankle Int 1994 Mar:15(3):97-102.
25. Neb M, Goyal M, Mahajan N. Association of chronic plantar heel pain with foot posture and functional limitation- a correlation study. International Journal of Physical Education, Sports and Health 2014;1(1):17-19.
26. Budiman-Mak E, Conrad KJ, Mazza J, Stuck RM. A review of the foot function index and the foot function index – revised. Journal of Foot and Ankle Research 2013; 6(5)1-37.
27. Kenneth G Saag, Charles L Saltzman, C. Kice Brown, Budiman-Mak E. The foot function index for measuring rheumatoid arthritis pain: Evaluating side-to-side Reliability. Foot & Ankle International, 1996 Aug: 17(8);506-510.

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