



INTERNATIONAL JOURNAL OF PHARMACEUTICAL RESEARCH AND BIO-SCIENCE

INFLUENCE OF CALCANEAL TAPING AND STRETCHING EXERCISES ON FUNCTIONAL STATUS AND CALCANEAL ANGLE IN SUBJECTS WITH PLANTAR FASCIITIS.

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Accepted Date: 13/11/2016; Published Date: 27/12/2016

Abstract: Back ground: To know the effect of calcaneal taping and stretching exercises on functional outcome and calcaneal angle in subjects with plantar fasciitis. **OBJECTIVES:** To analyze the effect of calcaneal taping and stretching exercises on functional outcome in subjects with plantar fasciitis through Foot Function Index. To analyze the effect of calcaneal taping and stretching exercises on calcaneal angle in subjects with plantar fasciitis through universal Goniometer. **METHODS:** 30 subjects who are met the selection criteria were selected randomly from college of physiotherapy, SVIMS, Tirupati. The study conducted for a period of 3 weeks. Two group, comparisons of 15 in each were formed. Experimental group received calcaneal taping and stretching exercises, Control group received only stretching exercises. Subjects were evaluated pre and post treatment for functional status and calcaneal angle. **RESULTS:** To test the significance of mean difference of two groups paired t- test was done. It is statistically shown that there is some significant impact in the parameters functional status and calcaneal angle. The results showed that, experimental group had more significant improvement in all parameters than the control group. **CONCLUSION:** Further upon analyzing the difference between both the groups, it was found that the experimental group has shown a significant improvement when compared to control group. Hence calcaneal taping, calf muscle and plantar fascia stretching plays an important role in improving the functional status and calcaneal angle in subjects with plantar fasciitis.

Keywords: Plantar fasciitis, Calcaneal taping, Stretching exercises, Foot Function Index.



PAPER-QR CODE

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Access Online On:

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How to Cite This Article:

Aishwarya NC, IJPRBS, 2016; Volume 5(6): 21-28

INTRODUCTION

Plantar fasciitis is a degenerative syndrome of plantar fascia resulting from repeated trauma at its origin on the calcaneus¹. Plantar fasciitis is reported to be the most common cause of inferior heel pain in adults². Other names for plantar fasciitis include painful heel syndrome, heel spur syndrome³, runner's heel, calcaneodynia and calcaneal periostosis⁴. The word "fasciitis" assumes inflammation is an inherent component of this condition. Recent research suggests that some presentations of plantar fasciitis manifests non-inflammatory, degenerative process and should more aptly termed "plantar fasciosis"^{3,5}.

In India more than one million individuals are treated for plantar fasciitis on an annual basis. Plantar fasciitis affects individuals regardless of sex, age, ethnicity, or activity level. It is seen in physically active individuals such as runners and military personnel, but also prevalent in general population, particularly in woman ages 40-60 years^{2,6,7}. The plantar fascia is a thickened fibrous sheet of connective tissue that originates from the medial tubercle on the undersurface of the calcaneus and fans out, attaching to the plantar plates of the metatarsophalangeal joints to form the medial longitudinal arch of the foot. It provides key functions during running and walking. The purpose of the plantar fascia is twofold – to provide support of the longitudinal arch and to serve as a dynamic shock absorber for the foot and entire leg.

The etiology of plantar fasciitis is poorly understood. While this condition can occur in association with various arthritides, the etiology is unknown in approximately 85% of cases⁸. Sudden increase in weight bearing activity particularly those involving running can cause micro-trauma to the plantar fascia⁹. Plantar fasciitis is likely the result of multiple risk factors. Recent case controlled studies have identified obesity or sudden weight gain, reduced ankle dorsiflexion pesplanus and occupation that require prolonged weight bearing as the greatest risk factors associated with plantar fasciitis.

Reports states that 81-86% of individuals with symptoms consisting with plantar fasciitis have excessive pronation of foot,¹excessive pronation is caused by plantarflexion and adduction of the talus during weight bearing, causing the calcaneus to evert. The biomechanics of an adducted talus and everted calcaneus results in increased tension in the structures on the plantar surface of the foot, causing arch to collapse and creating excessive stress on the plantar fascia.¹⁰⁻²¹

The most common symptom associated with plantar fasciitis is pain and discomfort in the inferior heel region, which is aggravated on weight bearing after a period of non-weight bearing. Patients report pain to be particularly bad with the few steps taken on rising in the morning. After few steps and through the course of the day, the heel pain diminishes, but returns if intense or prolonged weight bearing activity is undertaken.

Diagnosis of plantar fasciitis is usually made on the basis of history and physical examination. Plantar fasciitis is usually unilateral. Physical examination presents with localized tenderness at the anteromedial aspect of the calcaneus. Pain may be exacerbated by passive dorsiflexion of the toes. Diagnostic imaging is rarely indicated for initial evaluation and treatment, but may be helpful to rule out other causes of heel pain. Numerous non-surgical treatments have been used to relieve the symptoms associated with heel pain. These include rest^{22,23}, exercises^{15,19,22,24}, external support by means of orthotics, splints and taping^{10,14,17,20,21,25,26,27}, and modalities like cryotherapy, ultrasound with or without phonophoresis, electrical stimulation, whirlpool and administration of NSAIDS medications through Iontophoresis. Tight calf muscle is more prone to plantar fasciitis. Insufficient flexibility in the Achilles tendon during the landing phase can lead to overstress of plantar fascia, insufficient elasticity in the plantar fascia can be treated by regular stretching of plantar fascia and calf muscles, and it helps to withstand key twisting and lengthening forces which are placed during weight bearing activities.

There have been very few studies investigating the acute effects of attempting to control the position and alignment of the calcaneus during weight bearing through the use of tape. Previous strapping and taping techniques attempted to provide support for the arch rather than controlling the calcaneus. The purpose of this study was to examine the effects of a calcaneal taping that do not involve the medial arch of the foot, on the symptoms of plantar heel pain.

Hence there was a need of the study is to correct the excessive pronation by correcting calcaneal eversion through calcaneal taping and improving muscle flexibility by stretching

MATERIALS AND METHODS

The study procedure was designed in accordance with Helsinki declaration. Sample size was 30 Control group 15, Experimental group 15. Inclusion criteria was age group 20-50 years, both males and females. Unilateral heel pain with pain more during first few steps after rest. Control group was Stretching exercises for calf muscles and plantar fascia for 3 weeks. Experimental group was Calcaneal taping and stretching exercises for calf muscles and plantar fascia for 3 weeks.

Subjects were randomized by simple random sampling methods into two groups. Subjects underwent intervention in which pre and post evaluation was done. All subjects were screened after finding their suitability as per inclusion and exclusion criteria, they were requested to participate in the study. Experimental group consists of 15 subjects who were treated with calcaneal taping every alternate day for 3 weeks and passive calf muscles and plantar fascia stretching performed for 5 repetitions each held for a count of 30 sec for 3 weeks. Control group consists of 15 subjects who received only passive calf muscles and plantar fascia

stretching performed for 5 repetitions each held for a count of 30 sec for 3 weeks. The subjects in both the groups were clearly explained about the treatment protocol before starting the study and an Informed Consent had been taken from them. For passively stretching the Soleus muscle the knee is flexed and overpressure was placed upon the bottom of the foot, while the ankle was in dorsiflexion. The Gastrocnemius muscle was stretched passively by extending the knee and placing overpressure upon the bottom of the foot, while the ankle was in dorsi flexion. A passive stretch was applied to the great toe flexors to incorporate stretch to the plantar fascia. The stretch for both muscles and plantar fascia was performed for 5 repetitions each held for a count of 30 seconds. Calcaneal taping is a simple 4 piece taping, where piece 1 was applied just distal to the lateral malleolus, pulling the calcaneus medially and was attached to the medial aspect of foot distal to the medial malleolus. Pieces 2 and 3 follow the same pattern with overlap of approximately one third of the tape width. Piece 4 went around the back of the heel, starting distal to the lateral malleolus, wrapping around the posterior aspect of the calcaneus, and anchoring distal to the medial malleolus.

RESULTS

The entire analysis has been carried out using IBM SPSS Inc. 20.0 Version. The main objective of the work is to observe the statistical significance in the variables FFI and CA. The outcome measures are collected on two time periods i.e., Pre and Post with respect to FFI and CA. To meet the objectives, the statistical techniques used for this study are paired samples t-test and Independent samples t-test. The first technique was carried out separately for experimental and control groups and the later technique is used to compare experimental and control groups respectively.

Experimental Group

Table 1: Showing Mean and Std.Error of pre and post values within the experimental group

	Parameters	Pre values	Post values	t-value
		Mean ± Std.Error	Mean ± Std.Error	
Experimental group	FFI	0.6187 ± 0.018	0.3140 ± 0.018	19.671 (0.000*)
	CA	10.80 ± 0.368	6.40 ± 0.388	11.00 (0.000*)

On performing the Paired Samples t-test, it is observed that there is a statistical significance ($p < 0.05$) is existing between the pairs of observations of pre and post time periods of Experimental group. There is an improvement has been observed after treatment with respect to FFI and CA.

Independent samples t-test

Table 2: Showing the pre and post values of FFI and CA between two groups

Group Statistics	Group	Mean \pm Std. Error	t-value (Sig)
FFI	Experimental	0.3046 \pm 0.0154	16.032 (0.000*)
	Control	0.0493 \pm 0.0037	
CA	Experimental	4.40 \pm 0.400	8.934 (0.000*)
	Control	0.53 \pm 0.165	

On performing the Independent Samples t-test, it is observed that there is a statistical significance ($p < 0.05$) is existing between control and experiment with respect to FFI and CA. Also it is noticed that the Experimental group has found to be better with greater mean. In clear, the subjects of experimental groups showed better response than that of their counter parts.

DISCUSSION

This study examined the effects of a calcaneal taping and stretching exercises on the symptoms of plantar fasciitis. This taping technique differs from the other taping techniques in its biomechanical approach. The calcaneal taping technique inverts the heel to raise the medial longitudinal arch of the foot. In this study, stretching of calf muscle and plantar fascia and calcaneal taping was given to the experimental group, and stretching of calf and plantar fascia alone was given to the control group.

This study showed significant improvements for FFI and calcaneal angle in experimental group ($p < 0.05$). The control group showed significant improvement in FFI ($p < 0.05$) and there was no significance in calcaneal angle ($p < 0.006$) Previous studies have shown stretching to be a viable treatment technique for improving functional status associated with plantar fasciitis. In this study, the frequency of stretching may have been insufficient to get or expect greater results.

Previous studies have indicated that there is exaggerated pain during weight bearing activities. The plantar fascia plays an important role in providing foot support and rigidity, during weight bearing or loading, the plantar fascia allows for flexibility of the midfoot when conforming to the ground and provides shock absorption. At preswing, the metatarsophalangeal joints are in

extension, the plantar fascia is taut, and there is an increase in the height of the longitudinal arch which results in supination of the foot and assists in propulsion. Poor biomechanics in any of these phases can lead to foot pathology and associated plantar heel pain. Excessive pronation is a commonly cited risk factor for developing plantar heel pain. Excessive pronation is caused by plantar flexion and adduction of talus during weight bearing, causing the calcaneus to evert. Previous strapping and taping techniques attempted to provide sup Some studies shows that tightness of Achilles tendon or insufficient flexibility in achilles tendon leads to over stretch of plantar fascia, over pronate the foot thus stretching of plantar fascia and calf is important to treat plantar fasciitis.

In this study, stretching of calf muscle and plantar fascia and calcaneal taping was given to the experimental group, shows increase in functional ability and decrease in calcaneal angle causing the calcaneus to neutral and help in the treatment of plantar fasciitis.

Muscle function can be enhanced by providing additional input along the afferent limbs. The reflex arc that normally invoke muscle contraction during the functional activity. Taping the calcaneus to prevent excessive pronation and maintain a more neutral position presumably helps control the height of the medial longitudinal arch, thus taking the force off of the plantar fascia.

The results of this study had clearly shown that the experimental group treated by stretching and calcaneal taping gave better result in functional ability and calcaneal angle when measured with foot function index and universal goniometer respectively. When compared to the control group which received only stretching.

CONCLUSION

This study had shown that the group treated with stretching exercises and calcaneal taping had significant improvement in functional ability and calcaneal angle over the course of three weeks, compared with the group treated only with stretching exercises.

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