

Effectiveness of Nordic Hamstring Exercise and Positional Release Therapy in Treating Hamstring Tightness with Plantar Fasciitis: A Comparative Study

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Abstract: ***Problem Statement:** The degenerative condition resulting from the compressive force due to repeated trauma to the plantar fascia is known as plantar Fasciitis, gradual loss of hamstring flexibility, activity, disability, and increase in pain. The incidence of plantar fascia in patients with hamstring tightness is 8.7 times higher if compared with patients without hamstring tightness. **Approach:** The subjects were approached via the Department of Physiotherapy at Sri Venkateshwaraa Medical College Hospital and Research Centre, Ariyur, Pondicherry-605102. **Purpose:** To compare the effectiveness of Nordic hamstring exercise with positional release technique on subjects of hamstring tightness with plantar fasciitis. **Method:** The study design was a comparative study. 30 patients were selected from the SriVenkateshwara group of the institution (Ariyur- Pondy) They were allocated into two groups, group A(n=15) Nordic hamstring exercise, and group B (n= 15) positional release technique. The exercise was performed 8 weeks sessions progressed for each week, the outcome measures AKET and FFI were measured in pre and post-test for 8 week period. **Result:** Data analysis was done by paired t-test for within the group and unpaired t-test for between the group analysis respectively, the statistical analysis done with unpaired 't-test between the group A and group B analysis showed significant ($p<0.0001$) shows that the group A must be significant than group B, it has been concluded that group A shows reducing the pain and increasing in hamstring flexibility and activity with the outcome measure than group B. **Conclusion:** This study concludes thatthe Nordic Hamstring Exercise for group A shows more significance in reducing the pain and increasing hamstring flexibility and activity than the positional release technique in group B.*

Keywords: Nordic hamstring exercise, positional release technique, AKET, FFI score, hamstring flexibility, pain, activity, disability

1. Introduction

The incidence of plantar fasciitis in patients with hamstring tightness is 8.7 times higher if compared with patients without hamstring tightness¹. Increased hamstring tightness is caused by early contraction of the posterior leg muscles through the gait cycle and decreases ankle dorsiflexion. This functional biomechanical deficit causes significant increases in the tension of the plantar fascia, which is known to have minimal elasticity².

The hamstring muscle complex is comprised of three individual muscles the semitendinosus, semimembranosus, and biceps femoris muscle comprise the hamstring muscle group³.

'Windlass mechanism' is a well-known mechanical model described throughout the literature to depict the plantar fascia's critical role in providing dynamic support to the foot during weight-bearing activities, the windlass refers to the tightening of a rope or cable, it was originally described by hicks in 1950, the plantar fascia forms the supportive truss [or tie rod],with its corresponding arch consisting of the calcaneus, midtarsal joint, and the metatarsal[the medial longitudinal arch]⁵.

Plantar fasciitis is a degenerative condition resulting from compressive forces due to repeated trauma to the plantar fascia making the foot's longitudinal arch flat. traction

forces during the gait on support phase leading to inflammation results in fibrosis and degeneration⁵.

Nordic hamstring exercise is a kind of movement that does not require hamstring injuries and can be performed everywhere with own body weight to improve hamstring strength along with providing knee muscle strength balance. Nordic hamstring exercise is an effective tool to improve hamstring muscle strength and provide a higher increase in eccentric hamstring strength compared to normal hamstring curl exercises. Nordic can be performed exclusively on his body weight so that people of all age groups can perform comfortably⁶.

The positional release technique is an indirect and passive treatment originally termed strain counter strain is an osteopathic manual technique, that involves tissue in an ideal position of comfort, It acts on the muscle spindle and is associated with reflex mechanism, decreases the muscle tension, facial tension, hypo mobility, increase the muscle flexibility by the placing the muscle in a shortened to promote the muscle relaxation in contrast to placing the muscle in a lengthened or stretched position⁷.

Low-level laser effects cause the stimulation of the body's processes in healing tissue by light. Phototherapy increases the both local and systemic microcirculation of the body thus it relieves pain and swelling⁴.

[AKET], the active knee extension test measures the hamstring tightness by the angle subtended by knee flexion after a maximum active knee extension, with hip stabilization at 90 degrees. Hamstring muscle tightness is defined as knee extension angle [KEA] greater than 20 degrees where KEA is the degree of knee flexion from terminal knee extension⁸.

In 1991, the Foot Function Index (FFI) was developed as a self-reporting measure that assesses multiple dimensions of foot function based on patient-centered values. The FFI consists of 23 items divided into 3 subscales that quantify the impact of foot pathology on pain, disability, and activity limitation in patients with RA⁹.

2. Material and Methodology

This is a Comparative Study that includes 30 patients from the Department of Physiotherapy, Sri Venkateshwaraa Medical College Hospital and Research Centre, Ariyur, Pondicherry-605102. Subjects were divided into two groups (Group A- 15 & Group B- 15). The subjects were included based on the selection criteria. The inclusion criteria of the study were Subjects in the age group of 30 to 60 years, patients with a clinical diagnosis of Hamstring tightness with plantar fasciitis, Male genders included, Subjects who were willing to participate in the study, and exclusion criteria were subjects with any Recent hamstring injury and lowback surgery, calcaneal stress fracture and fracture around the ankle joint, the laser is contraindicated, positional release is contraindicated, neurological pain like sciatica, severe low back pain, not willing to participate in the study. In both groups, the subject's pre-test and post-test values were collected using Active Knee Extension Test and Foot Functional Index. The study was conducted for 6 months and during the study time subjects received Group A Nordic Hamstring Exercise and Group B Positional Release Technique for 8 weeks.

3. Procedure

Active Knee Extension Test &Foot Functional Index

Before giving the Nordic Hamstring Exercise and Positional Release Technique, the AKET and FFI scores were evaluated by the patient in each session. Instruction has been given to the patient, to inform about AKET and FFI Score during the treatment period.



Figure 1: Active Knee Extension Test

Group A: Nordic Hamstring Exercise

The NH exercise is a partner exercise where the subjects attempt to resist a forward-falling motion using their hamstring to maximize loading in the eccentric phase. The subjects were asked to keep their hips fixed in a slightly flexed position throughout the whole range of motion, and to fall as far as possible for their hamstring, 'let go'. They were asked to use their arms and hands to fall, let the chest touch the surface, and immediately get back to the starting position by forcefully pushing with their hands to minimize loading in the concentric phase. The effect of the force on the surface of the fingertip.

Nordic Hamstring Exercise Protocol

Week	Sessions Per Week	Sets and Repetitions	Load
1	1	2×5	Load is increased as a subject can withstand the forward fall longer. When managing to withstand the whole ROM for 12 reps, increase the load by adding speed to the starting phase of the motion. The partner can also increase loading further by pushing at the back of the shoulders.
2	2	2×6	
3	3	3×6-8	
4	3	3×8-10	
5-8	3	3 sets, 12, 10, 8 reps	



Figure 2: Starting Position (NH)



Figure 2.1: Mid Position (NH)

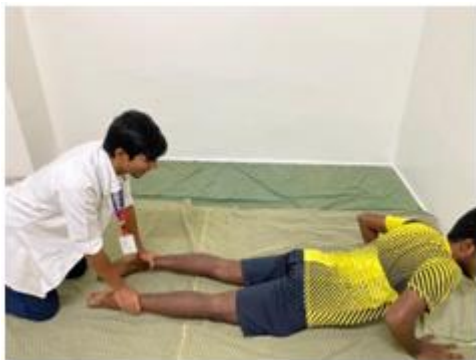


Figure 2.2: End Position (NH)



Figure 3: Starting Position (PRT)

Group B - Positional Release Technique

Medial Hamstring

This tender point is located on the posterior, medial surface of the tibia, on the tendinous attachments of the semimembranosus and the semitendinosus, pressure is applied anteriorly. The patient lies supine with the affected thigh extended and abducted off the edge of the table. The therapist then flexes the affected knee 40 degrees and adds slight adduction (varus force) and marked internal rotation of the tibia.

Lateral Hamstring

This tender point is located on the posterior, lateral surface of the head of the fibula, on the tendinous attachment of the biceps femoris. Pressure is applied anteromedially.

Position of the Treatment

The patient lies supine with the affected thigh extended and abducted off the edge of the table. The therapist flexes the affected knee approximately 40 degrees and then either abducts or adducts the lower leg (usually slight abduction, i.e., valgus force of the tibia) the tibia is then either internally or externally rotated (usually external rotation).



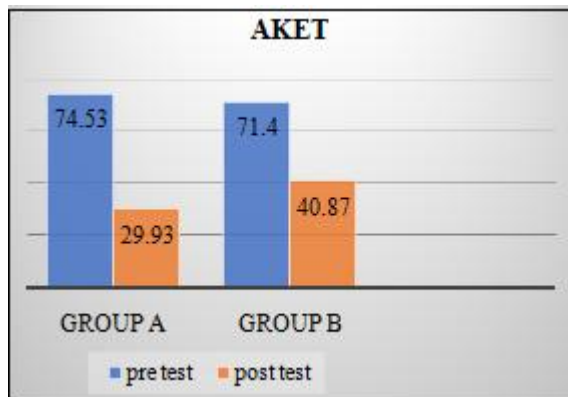
Figure 3.1: Ending Position (PRT)

4. Statistical Analysis and Results

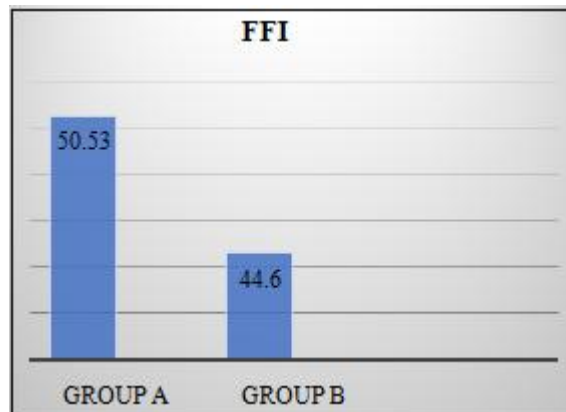
The data obtained were analyzed using both the paired and unpaired t-test and were tabulated. The calculated ‘t’ value obtained from paired ‘t-test of group A (within group analysis) of the AKET & FFI for 14 degrees of freedom and 5% level of significance was 26.71395 & 36.8117 and group B were 23.87954 & 38.1110 with the p-value <0.0005 (Table 1). In the statistical analysis obtained from the AKET & FFI, the mean values and SD obtained from Group A and Group B of AKET & FFI were 74.53 ± 4.79 & 29.93 ± 4.46 and 74.47 ± 4.76 & 23.93 ± 2.55, and 71.40 ± 4.03 & 40.87 ± 2.88 and 76.40 ± 4.22 & 31.80 ± 3.86 respectively. For 28 degrees of freedom and a 5% level of significance, the calculated ‘t’ values of AKET & FFI are 5.8928 and 3.2892 respectively (Table 2).

Table 1: Showing the Pre and Post-Values of Group A and B (Paired t-test Value)

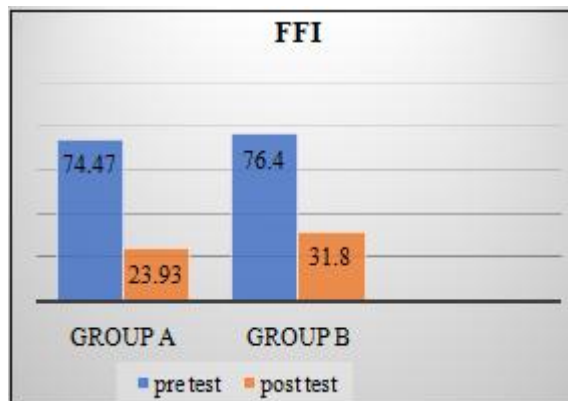
Outcome Tools	Groups	Pre-Test(Mean)	Post-Test (Mean)	Sd Pre-Test	Sd Post-Test	T- Value	P-Value
AKET	GROUP A	74.53	29.93	4.79	4.46	26.71395	<0.0005
	GROUP B	71.40	40.87	4.03	2.88	23.87954	<0.0005
FFI	GROUP A	74.47	23.93	4.76	2.55	36.8117	<0.0005
	GROUP B	76.40	31.80	4.22	3.86	38.1110	<0.0005



Graph 1: Within-Group Analysis of AKET



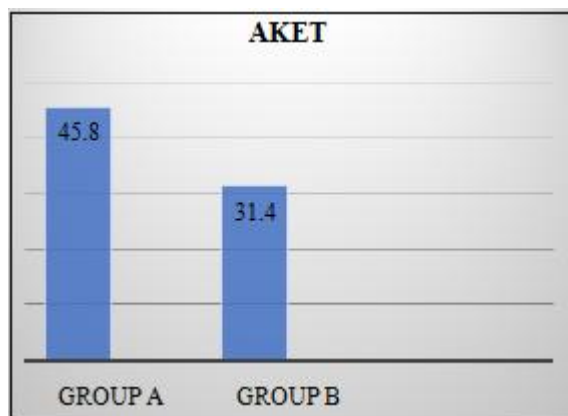
Graph 4: Between the group analysis of FFI



Graph 2: Within-Group Analysis of FFI

Table 2: Showing the Pre and Post-Values of Group A and B (Unpaired t-Test Value)

Outcome Tools	Groups	Pre & Post Test (Mean)	SD	t-value	p-value
AKET	GROUP A	45.80	8.50	5.8928	<0.0005
	GROUP B	31.40	4.17		
FFI	GROUP A	50.53	5.32	3.2892	<0.0005
	GROUP B	44.60	4.53		



Graph 3: Between the group analysis of AKET

5. Discussion

The presented study was conducted to find out the effectiveness of the Nordic Hamstring Exercise and the Positional Release Technique for hamstring tightness in plantar fasciitis patients. The pre and post-values were assessed before and after 8 weeks using outcome measures such as pain, hamstring flexibility, activity, and disability, the values were statistically analyzed using a repeated measure of paired 't' test.

Jonathan Lebovitz. (2011) studied study increased hamstring tightness causes early contraction of posterior leg muscle through the gait cycle and decreases ankle dorsiflexion This functional biomechanical deficit causes a significant increase in the tension of the plantar fascia, patients with hamstring tightness were approximately 8.7 as likely to have plantar fasciitis study concluded corresponding foot compared with patient without hamstring tightness.

Zait Burakaktug. (2018) study determined that the 8-week Nordic Hamstring Exercise increased muscle strength statistically, 21 male soccer players were divided 2 groups Nordic Hamstring curl exercise, and soccer players performed these exercises for 10 weeks, result of study Nordic Hamstring Exercise was found to have a higher strength developed in the hamstring, and also being a preventive factor in hamstring injuries, the study suggested Nordic hamstring exercise has shown that athletes developed eccentric hamstring muscle strength.

Shraddha kotwal. (2018) the study demonstrated Positional Release Technique works to reduce the hyperactivity of the myotatic reflex arc and to reduce the overwhelming afferent nerve impulse within the arc that may lead to an overflow of neurotransmitters into the associated dermatome resulting in referred pain, The study suggests positional release technique will reduction in localized spasm, increased range of motion, increased circulation and improves lymph drainage and increase the potential for more normal biomechanics. The result of a concurrent study demonstrated that 8 weeks of Nordic Hamstring Exercise helped in reducing pain and improvement in the hamstring flexibility active knee extension test score for patients with plantar fasciitis compared with positional release technique, Nordic hamstring exercise helped to reduce the pain and improve

the Hamstring Flexibility and improve active knee extension score.

6. Conclusion

The result of the study concluded that Nordic Hamstring Exercise (GROUP A) showed marked improvement in Hamstring Flexibility and significant improvement in reducing pain, disability, activity, and limitation to Positional Release Technique (GROUP B) among Hamstring Tightness with Plantar Fasciitis individuals within 8 weeks of treatment. Therefore, the null hypothesis is rejected.

7. Limitations and Recommendations

Limitation in this study small sample sizes was selected, the duration of the study was shorter, only age groups between 30-60 were taken, and only males were taken in this study.

Furthermore, the study recommended large sample size be selected. Studies can be done based on the other criteria excluded in the study, Studies can be compared with other interventions. Studies can be done with the inclusion of a proportionate number of male and female candidates with consideration of level of activity, Female samples can be included in further studies.

References

- [1] Mohamed A, Abd El-MegidPd, Fadl S, El-AzizyMd, Hatem M. The Correlation between Hamstring Tightness and Plantar Fasciitis. *The Medical Journal of Cairo University*. 2019 Mar 1;87(March):309-13.
- [2] Labovitz JM, Yu J, Kim C. The role of hamstring tightness in plantar fasciitis. *Foot & ankle specialist*. 2011 Jun;4(3):141-4.
- [3] Rodgers CD, Raja A. Anatomy, bony pelvis and lower limb, hamstring muscle. InStatPearls [Internet] 2022 Jan 29. StatPearls Publishing.
- [4] Koteeswaran K, Ramya K, Rajeshwari A, Pandian SK. Effectiveness of low-level laser therapy versus ultrasound therapy with plantar fascia stretching in subjects with plantar fasciitis. *Indian J Public Health Res Dev*. 2020 Jan 31;11:92-6.
- [5] Bourne M, Talkad A, Varacallo M. Anatomy, bony pelvis and lower limb, foot fascia.
- [6] Aktug ZB, Yilmaz AK, Ibis S, Aka H, Akarçesme C, Sökmen T. The Effect of 8-Week Nordic Hamstring Exercise on Hamstring Quadriceps Ratio and Hamstring Muscle Strength. *World Journal of Education*. 2018;8(3):162-9.
- [7] AM H, Kage Vijay B, Basavaraj C. Comparison of myofascial release and positional release therapy in plantar fasciitis—A clinical trial. *Physiotherapy and Occupational Therapy*. 2010 Oct;4(4):8.
- [8] Chaphekar A, Somarajan S, Naik M, Kothiya D, Nakrani J, Trivedi S, Chaudhary M. Prevalence of Hamstrings Tightness Using Active Knee Extension Test among Diamond Assorters. *Indian Journal of Public Health Research & Development*. 2021 Mar 1;12(2):7-11.
- [9] 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 Dec;6(1):1-37.
- [10] Mohamed A, Abd El-MegidPd, Fadl S, El-AzizyMd, Hatem M. The Correlation between Hamstring Tightness and Plantar Fasciitis. *The Medical Journal of Cairo University*. 2019 Mar 1;87(March):309-13.
- [11] Balius R, Pedret C, Iriarte I, Sáiz R, Cerezal L. Sonographic landmarks in hamstring muscles. *Skeletal radiology*. 2019 Nov;48:1675-83.
- [12] Lamba D. To evaluate the efficacy of 780 nm low-level laser therapy for the treatment of plantar fasciitis in South Western Ethiopia. *Executive Editor*. 2019 Apr;13(2):231.
- [13] Shamsi MB. Correlation Between SLR and Active Knee Extension Tests in LBP Patients with Tightened Hamstring. *Journal of Clinical Research in Paramedical Sciences*. 2019 Jun 30;8(1).
- [14] Pannalal PV. Comparison between the effect of Nordic eccentric hamstring exercise versus positional release therapy on hamstring flexibility and endurance in male cricketers.
- [15] Ulusoy A, Cerrahoglu L, Orguc S. Magnetic resonance imaging and clinical outcomes of laser therapy, ultrasound therapy, and extracorporeal shock wave therapy for the treatment of plantar fasciitis: a randomized controlled trial. *The Journal of Foot and Ankle Surgery*. 2017 Jul 1;56(4):762-7.
- [16] Sailor S, Mehta Y, Shah N, Trivedi A. A comparative study of muscle energy technique and positional release technique on hamstring flexibility in healthy individuals. *Journal of Integrated Health Sciences*. 2018 Jul 1;6(2):64-.
- [17] Kothawale S, Rao K. Effectiveness of positional release technique versus active release technique on hamstrings tightness. *International Journal of Physiotherapy and Research*. 2018;6(1):2619-2.
- [18] Kostuj T, Stief F, Hartmann KA, Schaper K, Arabmotlagh M, Baums MH, Meurer A, Krummenauer F, Lieske S. Using the Oxford Foot Model to determine the association between objective measures of foot function and results of the AOFAS Ankle-Hindfoot Scale and the Foot Function Index: a prospective gait analysis study in Germany. *BMJ Open*. 2018 Apr 1;8(4):e019872.
- [19] Mousavian A, Mohammadi A, Seyed-Hosseini SH, Shahpari O, Elahpour N, Orooji A, Ebrahimzadeh MH, Moradi A. Reliability and validity of the Persian version of the foot function index in patients with foot disorders. *Archives of Bone and Joint Surgery*. 2019 May;7(3):291.
- [20] Venditto T, Tognolo L, Rizzo RS, Iannuccelli C, Di Sante L, Trevisan M, Maggiolini FR, Santilli V, Ioppolo F. 17-Italian Foot Function Index with numerical rating scale: development, reliability, and validity of a modified version of the original Foot Function Index.