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Research Article

Efficacy of Active Straight Leg Raise (ASLR) Versus Passive Straight Leg Raise (PSLR) on Hamstring Extensibility among Short Hamstring Syndrome Population

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A B S T R A C T

Background of the Study: The research question addressed in this study is: How effective are the ASLR and PSLR techniques in improving hamstring tightness and range of motion among individuals with short hamstring syndrome? The condition where the hamstring muscles are shorter than usual is called short hamstring syndrome. It has been demonstrated that the ASLR and PSLR techniques effectively reduce hamstring tightness and increase range of motion. This research aims to help determine how well these methods work for those with short hamstring syndrome.

Method: 100 subjects were selected for the study. ASLR group was given the active straight leg raise technique, and the PSLR group was given the passive straight leg raise technique for a 4-week treatment course. The study parameters include a Sit and reach test for hamstring tightness and an Active knee extension test for a range of motion pre-test and post-test comparison done between the groups.

Results: There is a significant difference between the two treatments (ASLR group and PSLR group) in terms of improvement in hamstring tightness ($t = 9.9$, $p = 0.000 > 0.05$). There is a significant difference between the two treatments (ASLR group and PSLR group) in terms of improvement in range of motion ($t = 7.2$, $p = 0.000 > 0.05$).

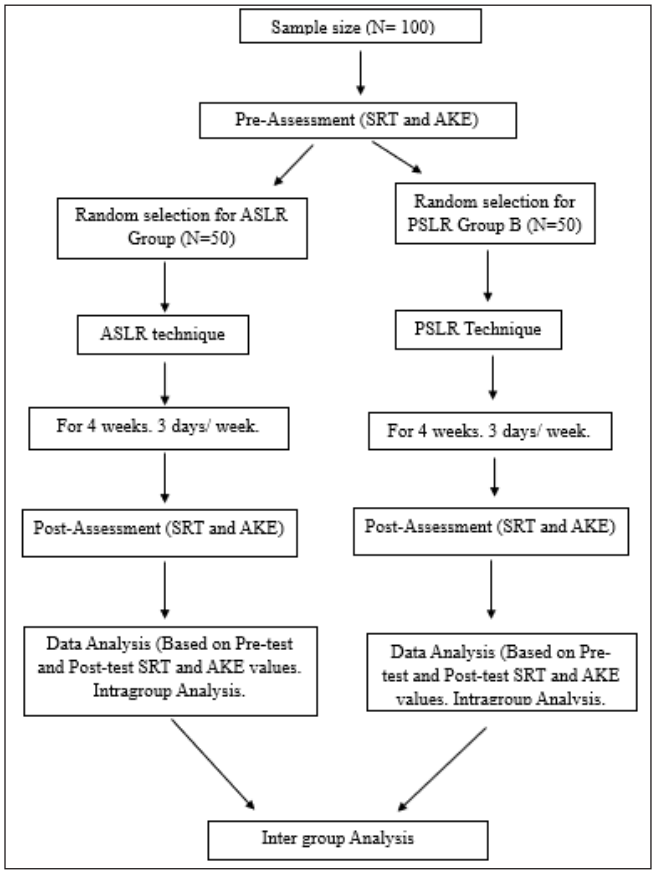
Conclusion: ASLR treatment was more effective than PSLR treatment in terms of changes in all the outcome measures.

Keywords: ASLR, PSLR, Short Hamstring Syndrome, SRT, AKET

Introduction

Short Hamstring Syndrome (SHS) is defined as a restriction of hip flexion when the knee is extended or a restriction of knee extension when the hip is flexed. The condition known as SHS is characterised by short, tight hamstring muscles located at the back of the leg. This might lead to several symptoms, such as knee pain, hip discomfort, and low back pain. It might be caused by various factors, including repeated activities that strain the hamstrings and postural and muscle abnormalities.[1] SHS is frequently seen during sports and work-related activities. Several variables, including exhaustion, poor muscle balance, inadequate flexibility, and past injuries, impact it.[2] Individuals with strained hamstrings and abnormal mechanosensitivity might also have poor hamstring extensibility.[3] Many popular sports and jobs requiring physical activity frequently result in short hamstring syndrome.[4,5] Though hamstring length has a significant role in human posture and the effectiveness of everyday activities like walking and running, people often have relatively limited hamstring flexibility.[6,7] Previous research has shown that low hamstring flexibility can negatively impact typical biomechanical patterns, which can limit mobility, cause postural deviations, cause discomfort, and raise the risk of injury. These effects can also affect balance, functioning, and sports performance.[8] The connection of the hamstring muscle to the ischial tuberosity causes a posterior rotation of the pelvis when standing, which is linked to SHS. Low back discomfort results from posterior pelvic tilt brought on by tight hamstring muscles, which also reduce lumbar lordosis.[9] Tight hamstrings in elderly persons can cause lower stride length and walking speed, affecting dynamic balance.[10] SHS often begins in childhood and worsens with age due to muscle elasticity loss and decreased exercise levels, gradually reducing hamstring flexibility. Active straight leg raise (ASLR) is a frequent exercise for assessing multi-segmental control. It is an effective exercise for measuring and developing hip mobility, flexibility, and strength in the hamstrings, core stability and strength, Pelvic control, Lower back stability, Hip flexor strength and control. The Passive Straight Leg Raise (PSLR), a flexibility exercise, involves the patient lying on their back while a therapist or assistive equipment raises one leg. This exercise primarily aims to develop hip joint flexibility and stretch the hamstrings.[11] PSLR is a common exercise that increases flexibility and range of motion in the lower back and hamstrings. PSLR is a popular clinical test used to assess the lumbar spine's flexibility, the posterior thigh's extendibility, and the effectiveness of stretching and mobilising methods.[12] The SRT is a commonly used tool for assessing muscular flexibility. Physical education classes, fitness evaluations, and health exams often employ this test. It is difficult to pinpoint the exact degree of hamstring flexibility in the straight leg lift since varying spine angles may affect the score.[13,14] The Ankle-Knee Extension (AKE) test is a special test used to assess the integrity of the knee joint's Anterior Cruciate Ligament (ACL). It's a valuable tool for healthcare professionals, especially physical therapists and orthopaedic specialists.

Figure 1.Flowchart for the Study



Aim of the Study

The study investigates the effectiveness of two physiotherapy techniques, active straight leg raise and passive straight leg raise, in improving hamstring flexibility of short hamstring syndrome among university students. The study will compare the outcomes of both techniques on hamstring tightness in the short hamstring syndrome population to identify the most effective technique for improving the range of motion in SHS. The study's results may be valuable for people seeking alternate therapy to manage short hamstring syndrome.

Objectives of the Study

- To determine the efficacy of active straight leg raises on hamstring tightness among the short hamstring syndrome population
- To determine the efficacy of passive straight leg raises on hamstring tightness among the short hamstring syndrome population

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- To compare the effectiveness of active straight leg raises and passive straight leg raises in improving hamstring flexibility in the short hamstring syndrome population

Materials and Method

This experimental study had pre-test and post-test results. The time frame for conducting this investigation was January–May 2024. The study was ethically approved by the Institutional Human Ethics Committee for student research (CARE IHEC-I/2231/23). One hundred participants were chosen and divided into two groups, the ASLR group and the PSLR group, with 50 individuals each. Based on the outcome measurements, pre-test values were obtained for hamstring tightness using the SRT and range of motion using the AKET. It was considered the baseline reading, and the post-test readings were obtained during the fourth week of post-therapeutic intervention. The pre-test and post-test interventions were compared based on the sit-and-reach test and active knee extension.

- **Study Setting:** The subjects were referred from the Physiotherapy Department of Chettinad Academy of Research and Education.
- **Study Duration:** The total duration of the study was about 4 weeks.
- **Sample Size:** The sample size was 100. Students studying in the Bachelor of Physiotherapy Course at the Chettinad Academy of Research and Education were included.
- **Sampling Technique:** Convenient sampling approach Statistical Tool: Paired unpaired T test were used.
- **Inclusion Criteria:** Physically inactive, non-injured participants, tight thigh muscles, and MSLR < 70%
- **Exclusion Criteria:** Lower extremity injury, lumbar pathology, lower extremity surgery within 6 months, vestibulocochlear disturbances, joint hypermobility syndrome, and lower extremity neurovascular pathology

Procedure

All 100 participants provided a signed consent form. A convenient sample technique was used to choose them. Their inclusion and exclusion criteria were used to choose the subjects. The subjects were given information in their native language about the study's methodology, goals, risks, advantages, and results. The subjects were conveniently divided into two groups (ASLR and PSLR groups). ASLR Group was given the Active straight leg raise intervention, whereas PSLR Group was given the Passive straight leg raise intervention. Pre-tests were conducted using the sit and reach test for hamstring tightness and the active knee extension test for range of motion.

ASLR Group

ASLR Group participants were chosen according to their inclusion and exclusion standards in the case of the ASLR group subjects. The ASLR is frequently used to evaluate and enhance hip mobility, core stability, and lower limb strength. It's particularly beneficial for people who need to enhance their functional movement patterns, such as athletes, people healing from hip or lower back problems, or people with hip and lower back discomfort. Each leg underwent 4 active straight leg lift repetitions followed by a 30-second hold.

- **Patient Position:** The patient is comfortable resting their arms at their sides while lying on their back with their legs outstretched. There should be touch with the surface underneath them over the whole spine length.
- **Therapist Position:** The therapist stood behind the patient.
- **Procedure:** The mechanism involves a combination of muscle activation and joint movement to improve stability, mobility, and strength. The exercise of the active straight leg lift is carried out by lying on the back on a flat surface, such as a yoga mat with legs straight out. Keep one leg flat on the ground while slowly lifting the other leg straight up. Keep the lifted leg as straight as possible without bending the knee. Raise the leg until you feel a stretch in the back of the thigh (hamstring), keep the pelvis stable, and avoid arching the lower back. Hold the raised position for 30 seconds, then slowly lower the leg back down to the starting position. Repeat the exercise with the opposite leg. This technique should be performed 4 repetitions daily, three days a week, with a 30-second hold in between.

PSLR Group

Subjects in the PSLR Group were chosen by the inclusion and exclusion criteria. The passive straight leg lift exercise helps with hamstring flexibility, musculoskeletal issues, nerve stress assessment, and rehabilitation progress tracking. 4 repetitions of the passive straight leg raise technique were given.

- **Patient Position:** The patient lies on their back with extended legs, comfortably resting their arms by their sides. Throughout the whole length of the spine, there should be contact with the surface underneath them.
- **Therapist Position:** The therapist stood behind the patient.
- **Procedure:** The passive straight leg lift exercise is performed by leg lift when a therapist helps a patient elevate their leg while maintaining a straight knee. The

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patient should lie flat on their back on a comfortable surface, such as a mat or treatment table. The therapist is beside the patient, facing their side. The therapist's arms should be positioned under the patient's calf below the knee joint. Before starting, explain the procedure clearly to the patient. The therapist raises the patient's leg by being supported beneath the calf. The assistant raises the patient's leg while maintaining a straight knee until the patient feels a mild hamstring strain. To give the patient time to feel the stretch, the therapist maintains the elevated posture for 30 seconds. Repeat the exercise with the opposite leg. This technique should be performed 4 repetitions daily, three days a week, with a 30-second hold in between. Outcome Measures: Sit and Reach Test, Active Knee Extension Test

Results

Descriptive and inferential statistics were used to analyse the gathered data. All the data gathered was subjected to the mean and standard deviation. Analysing the significant variations between measures taken before and after the test, an unpaired t test was utilised to examine any significant differences between the groups in addition to the paired t test.

Baseline Demographic Data

As shown in Tables 1 and 2, in the ASLR Group, 28 (56.0%) respondents were female and 22 (44%) were male with a mean age of 19.8800 years and a BMI of 24.8140. In the PSLR Group, 25 (50.0%) respondents were female and 25 (50.0%) were male with a mean of age 20.2600 years and a BMI of 25.7240.

Comparison between ASLR and PSLR in Sit and Reach Test

Table 3 reveals the following:

- As per the results of the sit and reach pre-tests, the mean value for ASLR was 5.3480; for PSLR, it was 1.9420 with a mean difference of 3.4. The p value was 0.000 (significant as less than 0.05 at a 95% confidence interval). Thus, a significant relationship was observed between ASLR and PSLR in the pre-test.
- As per the sit and reach post-test (2nd week), the mean value for ASLR was 6.4820; for PSLR, it was 3.6440 with a mean difference of 2.8. The p value was 0.000 (significant as less than 0.05 at a 95% confidence interval). Thus, a significant relationship was seen in the sit and reach post-test (2nd week) between ASLR and PSLR.
- The results of the sit and reach post-test (4th week) showed that the mean value for ASLR was 8.1300 and for PSLR, it was 5.9000 with a mean difference of 2.2. The p value was 0.000 (significant as less than 0.05 at a 95% confidence interval). Thus, a significant relationship was observed in the sit and reach post-test (4th week) between ASLR and PSLR.

Comparison between ASLR and PSLR in Active Knee Extension Test

Table 4 reveals the following:

- In the pre-test, the mean value for ASLR was 50.5000, and for PSLR, it was 41.9800 with a mean difference of 8.5. The p value was 0.000 (significant as less than 0.05 at a 95% confidence interval) indicating a significant relationship between ASLR and PSLR in the active knee extension pre-tests.
- The active knee extension post-test (2nd week) revealed the mean value for ASLR to be 53.9000, and for PSLR, it was 43.6800 with a mean difference of 10.2. The p value was 0.000 (significant as less than 0.05 at a 95% confidence interval). Therefore, a significant relationship was observed in the active knee extension post-test (2nd week) between ASLR and PSLR.
- As per the active knee extension post-test (4th week), the mean value for ASLR was 56.0000, and for PSLR, it was 46.3800, with a mean difference of 9.6. The observed p value was 0.000 (significant as less than 0.05 at a 95% confidence interval), revealing a significant relationship between ASLR and PSLR in the active knee extension post-test (4th week).

Table 1.Gender Distribution in ASLR Group and PSLR Group

Group	Variable	Frequency	Percentage	Valid Percentage	Cumulative Percentage
ASLR	Male	22	44.0	25.0	50.0
	Female	28	56.0	25.0	50.0
	Total	50	100.0	50.0	100.0
PSLR	Male	25	50.0	50.0	50.0
	Female	25	50.0	50.0	100.0
	Total	50	100.0	100.0	-

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Table 2.Age and BMI Distribution in ASLR Group and PSLR Group

Group	N	Age		BMI	
		Mean	Std Deviation	Mean	Std Deviation
ASLR	50	19.8800	1.04276	24.8140	2.70917
PSLR	50	20.2600	0.92162	25.7240	2.73545

Table 3.Comparison between ASLR & PSLR in Sit and Reach Test

Test	ASLR		PSLR		t Value	p Value
	Mean	Std Deviation	Mean	Std Deviation		
Sit and reach pre-test	5.3480	0.71092	1.9420	1.08366	18.583	0.000
Sit and reach post-test (2nd week)	6.4820	0.83999	3.6440	1.19457	13.742	0.000
Sit and reach post-test (4th week)	8.1300	1.11999	5.9000	1.12486	9.934	0.000

Table 4.Comparison between ASLR and PSLR in Active Knee Extension Test

Test	ASLR		PSLR		t Value	p Value
	Mean	Std Deviation	Mean	Std Deviation		
Active knee extension pre-test	50.5000	6.08192	41.9800	5.56039	7.311	0.000
Active knee extension post-test (2nd week)	53.9000	4.97853	43.6800	5.73012	9.520	0.000
Active knee extension post-test (4th week)	56.0000	3.64216	46.3800	8.61392	7.273	0.000

Discussion

The study found that the active stretching method resulted in a higher increase in active knee extension range of motion, nearly preserved four weeks following the conclusion of the exercise. In contrast, the passive method reversed the gain. Compared to static stretching, the active stretching approach required less compliance to affect flexibility and was more time-efficient.[15] We advise active stretching as it takes significantly fewer sessions to complete. The study summarises that active stretching combined with TENS causes children who play soccer with the SHS to improve more than one alone, and these two are superior to the traditional stretching frequently used in training.[16] It is also important to stretch all muscle groups, especially the hamstring muscles. One of our goals is to increase awareness of the significance of stretching so that it becomes ingrained. The author summarised that active stretching at home was useful for paediatric patients' hamstring muscle tension. Such training is recommended for adolescent athletes to preserve flexibility and prevent spinal diseases.[17,18] The group that received passive stretches that involved straight leg raises (SLRs) showed the most gain in hamstring length. Age, starting tightness, or the amount of activity each week did not correlate with hamstring flexibility. The SLR passive stretch produced the most improvement in hamstring flexibility. Additionally, compared to the 90/90 passive approaches, using PNF in the active stretch improved the knee range of motion more effectively.[19,20] Active stretching has been shown to increase the flexibility of tight muscles while also increasing the function of antagonistic muscles.[21,22] Our findings indicate active stretching as an effective way to increase the flexibility of stiff hip flexor muscles. Previous

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studies suggest that an active or passive stretching treatment can improve ROM in young individuals with low back pain and lower-extremity complaints by stretching tight hip flexors.[23] More research is needed to discover whether active stretching improves the function of antagonist muscles more than passive stretching or if both strategies are equally beneficial in enhancing the flexibility of other muscle groups.[24] Finally, the results of this study show that SHS patients may effectively improve their range of motion and lessen hamstring tightness by implementing both the ASLR and PSLR techniques. These treatments provide conservative, non-invasive treatment options for SHS that may be included in the care of physiotherapists. Additional research is necessary to compare the efficacy of these strategies to other physiotherapy therapies for SHS patients and look into the long-term implications of these techniques. Finally, the results of this study show that in SHS patients, the ASLR more successfully improves the range of motion and reduces tightness.

Conclusion

Hence, it is concluded that ASLR Treatment significantly reduced hamstring tightness and improved the range of motion in the short hamstring syndrome population. The outcomes of this study demonstrate that both ASLR and PSLR can successfully reduce tightness and enhance the range of motion in SHS patients.

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Conflict of Interest: None

References

1. Hansberger BL, Loutsch R, Hancock C, Bonser R, Zeigel A, Baker RT. Evaluating the relationship between clinical assessments of apparent hamstring tightness: a correlational analysis. Int J Sports Phys Ther. 2019 Apr;14(2):253. [PubMed] [Google Scholar]
2. Vakhariya P, Panchal S, Patel B. Effects of various therapeutic techniques in the subjects with short hamstring syndrome. Int J Physiother Res. 2016;4(4):1603-10. [Google Scholar]
3. Anandhraj J, Kumaresan A. Effect of neurodynamic sliding technique on hemiplegic stroke subjects with hamstring tightness. Indian J Public Health Res Dev. 2020 Jan 31;11(1):251-4. [Google Scholar]
4. Bahr R, Holme I. Risk factors for sports injuries—a methodological approach. Br J Sports Med. 2003;37(5):384-92. [PubMed] [Google Scholar]
5. Davis DS, Ashby PE, McCale KL, Mcquain JA, Wine JM. The effectiveness of 3 stretching techniques on hamstring flexibility using consistent stretching parameters. J Strength Cond Res. 2005 Feb 1;19(1):27-32. [PubMed] [Google Scholar]
6. Gajdosik RL, Giuliani CA, Bohannon RW. Passive compliance and length of the hamstring muscles of healthy men anc women. Clin Biomech (Bristol, Avon). 1990 Feb;5(1):23-9. [PubMed] [Google Scholar]
7. Ayala F, de Baranda PS, Croix MD, Santonja F. Comparison of active stretching technique in males with normal and limited hamstring flexibility. Phys Ther Sport. 2013 May;14(2):98-104. [PubMed] [Google Scholar]
8. Forman J, Geertsen L, Rogers ME. Effect of deep stripping massage alone or with eccentric resistance on hamstring length and strength. J Bodyw Mov Ther. 2014 Jan;18(1):139-44. [PubMed] [Google Scholar]
9. Thakur D, Rose S. A study to find out the correlation between the right and left hamstring length in both genders to determine the prevalence of hamstring tightness among college students. J Health Allied Sci NU. 2016 Dec;6(4):46-52. [Google Scholar]
10. Hartig DE, Henderson JM. Increasing hamstring flexibility decreases lower extremity overuse injuries in military basic trainees. Am J Sports Med. 1999 Mar;27(2):173-6. [Google Scholar]
11. Clark S, Christiansen A, Hellman DF, Hugunin JW, Hurst KM. Effects of ipsilateral anterior thigh soft tissue stretching on passive unilateral straight-leg raise. J Orthop Sports Phys Ther. 1999 Jan;29(1):4-12. [PubMed] [Google Scholar]
12. Lim W. The test-induced warm-up effect on hamstring flexibility tests. Hong Kong Physiother J. 2024 Dec;44(2):119-25. [PubMed] [Google Scholar]
13. Miñarro PA, de Baranda Andújar PS, García PL, Toro EO. A comparison of the spine posture among several sit-and-reach test protocols. J Sci Med Sport. 2007 Dec;10(6):456-62. [PubMed] [Google Scholar]
14. Takasaki H, Kawazoe S. Active straight leg raising (ASLR) competence improves with reverse-ASLR exercises and not repeating ASLR exercises. J Exerc Rehabil. 2021 Feb;17(1):28. [PubMed] [Google Scholar]
15. Özüdoğru A, Canlı M, Gürses ÖA, Alkan H, Yetiş A. Determination of five times-sit-to-stand test performance in patients with multiple sclerosis: validity and reliability. Somatosens Mot Res. 2023;40(2):72-7. [PubMed] [Google Scholar]
16. Pérez CA, Pérez SÁ, Baamonde SG, de Quel ÓM. Influence of the box dimensions on the reliability and validity of the sit and reach in preschoolers. J Strength Cond Res. 2020 Sep;34(9):2683-92. [PubMed] [Google Scholar]
17. Balachandran AT, Vigotsky AD, Quiles N, Mokkink LB, Belio MA, Glenn JM. Validity, reliability, and measurement error of a sit-to-stand power test in older

adults: a pre-registered study. Exp Gerontol. 2021 Mar 1;145:111202. [PubMed] [Google Scholar]
18. Mier CM, Shapiro BS. Reliability of a computer software angle tool for measuring spine and pelvic flexibility during the sit-and-reach test. J Strength Cond Res. 2013 Feb;27(2):501-6. [PubMed] [Google Scholar]
19. Meroni R, Cerri CG, Lanzarini C, Barindelli G, Morte GD, Gessaga V, Cesana GC, De Vito G. Comparison of active stretching technique and static stretching technique on hamstring flexibility. Clin J Sport Med. 2010 Jan 1;20(1):8-14. [PubMed] [Google Scholar]
20. Piqueras-Rodríguez F, Palazón-Bru A, Gil-Guillén VF. Effectiveness analysis of active stretching versus active stretching plus low-frequency electrical stimulation in children who play soccer and who have the short hamstring syndrome. Clin J Sport Med. 2016 Jan 1;26(1):59-68. [PubMed] [Google Scholar]
21. Sato M, Mase Y, Sairyo K. Active stretching for lower extremity muscle tightness in pediatric patients with lumbar spondylolysis. J Med Invest. 2017;64(1.2):136-9. [PubMed] [Google Scholar]
22. Fasen JM, O'Connor AM, Schwartz SL, Watson JO, Plastaras CT, Garvan CW, Bulcao C, Johnson SC, Akuthota V. A randomized controlled trial of hamstring stretching: comparison of four techniques. J Strength Cond Res. 2009 Mar 1;23(2):660-7. [PubMed] [Google Scholar]
23. White SG, Sahrmann SA. A movement system balance approach to management of musculoskeletal pain. Phys Ther Cerv Thorac Spine. 1994;2:339-57.
24. Winters MV, Blake CG, Trost JS, Marcello-Brinker TB, Lowe LM, Garber MB, Wainner RS. Passive versus active stretching of hip flexor muscles in subjects with limited hip extension: a randomized clinical trial. Phys Ther. 2004 Sep 1;84(9):800-7. [PubMed] [Google Scholar]

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