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Original Article

The Effectiveness of SLR Stretching and Pelvic Tilt Control Stretching on SLR Range Among Asymptomatic Females with Hamstring Tightness

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ABSTRACT

Background: Hamstring muscle tightness is a significant factor that impedes performance in daily and sports activities, necessitating the need for effective stretching techniques to enhance hamstring flexibility. This is particularly important for an active, physically fit lifestyle, as hamstring tightness is linked to various musculoskeletal issues and injuries.

Objective: This study aimed to evaluate and compare the effectiveness of Passive Straight Leg Raise (SLR) stretching and Pelvic Tilt Control Stretching in improving hamstring flexibility among asymptomatic young females with hamstring tightness.

Methods: In a quasi-experimental trial conducted at the Arif Memorial Teaching Hospital and Riphah International University, Lahore, 50 female participants aged 20-40 years with unilateral hamstring tightness were randomly assigned to either the Passive SLR stretching group or the Pelvic Tilt Control Stretching group. The efficacy of the stretching techniques was assessed using the active knee extension test, measured with a goniometer, both pre- and post-treatment.

Results: The Pelvic Tilt Control Stretching group showed a significant improvement in hamstring flexibility, with the mean post-treatment active knee extension significantly increasing from the pre-treatment measurement (p-value = 0.000). In contrast, the Passive SLR group showed no significant change in flexibility (p-value = 0.872). The study also highlighted the prevalence of a sedentary lifestyle among participants and its potential contribution to reduced hamstring flexibility.

Conclusion: The study concludes that Pelvic Tilt Control Stretching is an effective method for improving hamstring flexibility in young, asymptomatic females, suggesting its incorporation into physical therapy practices. This finding is particularly relevant for populations prone to hamstring tightness due to sedentary lifestyles.

Keywords: Hamstring Flexibility, Pelvic Tilt Control Stretching, Passive Straight Leg Raise, Young Females, Muscle Tightness, Physical Therapy, Sedentary Lifestyle.

INTRODUCTION

Hamstring muscle tightness is a critical factor impeding performance in daily and sports activities, underscoring the importance of enhancing hamstring flexibility for an active, physically fit lifestyle (1). Flexibility is defined as the muscle's ability to elongate, allowing joints in a region to achieve a specific range of motion (ROM) (2). The hamstring muscle complex, comprising the semitendinosus, semimembranosus, and biceps femoris, plays a pivotal role in lower limb and pelvic motion. These muscles originate at the ischial tuberosity and insert at various points in the lower leg, contributing to pelvic tilt, sacral rotation, and hip extension and rotation (3, 4). Hamstring strains, often recurring, are a prevalent injury, highlighting the importance of flexibility in this muscle group (5).

Hamstrings are integral to everyday activities, such as trunk movement, walking, and jumping. Reduced muscle flexibility, or the muscle's diminished capacity to deform during motion, leads to a decreased ROM and potentially increases the risk of injuries and musculoskeletal disorders (6). Additionally, hamstring flexibility is linked to lower back pain recovery and is crucial in reducing anterior pelvic tilt during trunk forward bending, which can exacerbate lumbar stress (7, 8). Tight hamstrings, often associated with

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postural changes, can also destabilize the sacroiliac joint (9, 10). Furthermore, hamstring tightness can result from the muscle's inability to elongate during motion, impacting joint ROM and potentially leading to dysfunctional motor control patterns (11, 12).

Hamstring muscle tightness is typically assessed through the finger-floor distance (FFD) and straight leg raise (SLR) tests. A reduced hamstring flexibility is indicated if an individual cannot touch the floor with fingertips during spinal flexion or if the SLR test result is less than 80° (13). Various stretching exercises, such as static, contract-relax, ballistic, and neuro-dynamic stretching, have been implemented to improve muscle length and flexibility. These are fundamental in sports programs, considering their impact on muscle contractile properties. Initial treatment objectives often focus on reducing muscle bleeding and controlling inflammation through methods like cryotherapy and compression bandages (13, 15). Moreover, the involvement of neural tissues, such as the sciatic nerve, in hamstring flexibility has been recognized, with prolonged sitting and standing contributing to tightness (16).

Despite clinical and experimental successes, no consensus exists on a standard stretching protocol. Static stretching, performed without additional movement and aiming to improve visco-elastic properties and stretch tolerance, is often seen as the most effective and safest method, typically involving 30-second stretches (17, 18). Studies, such as those by Kuszewski et al., have explored the relationship between hamstring stiffness and pelvic tilt, finding that increased stiffness correlates with increased anterior pelvic tilt (19). Various stretching techniques, including static and ballistic stretching, and proprioceptive neuromuscular facilitation, are employed in clinical settings, with active and passive stretching being easy to perform and commonly included in home rehabilitation programs. Active stretching has been shown to enhance flexibility and antagonist muscle performance (20).

Dynamic range of motion (DROM) stretching, a newer active stretching technique, offers an alternative to static stretching. DROM benefits from reciprocal nerve supply, though some studies, like those by Bandy et al., suggest that passive stretching may be more effective, albeit under varying stretching conditions, making direct comparisons challenging (21). Despite numerous studies comparing different stretching interventions for hamstring tightness and hip flexion ROM, there is a dearth of research specifically comparing passive SLR and pelvic tilt control stretching in asymptomatic females. Thus, this study aims to fill this gap by evaluating the effectiveness of pelvic tilt control stretching in treating hamstring tightness among this demographic.

MATERIAL AND METHODS

In this quasi-experimental trial, the efficacy of a single treatment technique was assessed on a group of subjects at the physical therapy department OPD of Arif Memorial Teaching Hospital and Riphah International University, Lahore. A total of 50 subjects were selected for the study through a non-probability purposive sampling technique, employing coin tossing for randomization. These subjects were evenly divided into two groups, with 25 in each: Group A, receiving SLR stretching, and Group B, undergoing Pelvic tilt control stretching.

Prior to the commencement of the study, participants were meticulously screened to meet the eligibility criteria. The study focused on females aged between 20 to 40 years, exhibiting limited SLR range of motion and unilateral hamstring tightness. Exclusion criteria were stringent, ruling out individuals with red flags such as tumors, fractures, metabolic diseases, rheumatoid arthritis, osteoporosis, a resting blood pressure exceeding 140/90 mmHg, prolonged steroid use, positive neurological signs indicative of nerve root compression (including major muscle group weakness in the lower extremity, diminished lower extremity deep tendon reflexes, or reduced sensation to pinprick in any lower extremity dermatome), a diagnosis of piriformis syndrome, or skin edema.

The study maintained a single-blind design, with subjects unaware of the alternative group options, though they were instructed to report any adverse effects during the trial. The goniometer was utilized as the primary data collection tool, and the active knee extension test served as the screening instrument.

Potential participants were approached and requested to participate in the study. After obtaining written informed consent, each participant drew a number from a box to determine their group allocation: number one for Group A and number two for Group B. The researcher then conducted a comprehensive case history, a full physical examination, and a regional assessment for each participant. This was followed by measuring the pre-treatment reading of the active knee extension test using a goniometer.

Treatment was administered according to the allocated groups. Post-treatment, a second reading of the active knee extension test was taken to evaluate the intervention's effectiveness. Data analysis was conducted using SPSS for Windows software, version 25, ensuring a rigorous statistical approach. Statistical significance was set at a p-value of 0.05. Paired t-tests were employed to discern any differences between baseline and post-treatment readings, focusing specifically on SLR ROM measurements in the hip flexion dimension. This comprehensive approach ensured a thorough evaluation of the treatment's efficacy in improving hamstring flexibility among the study participants.

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RESULTS

In the presented study, two groups were compared: one undergoing Passive Straight Leg Raise (SLR) stretching and the other Pelvic Tilt Control Stretching. The demographic data, detailed in Table 1, reveals that the mean age of participants in the Passive SLR group was 23.00 years with a standard deviation of 1.848, and the p-value for age difference was 0.078. This group's average height was 161.48 cm, and weight was 50.70 kg, with respective standard deviations of 4.063 and 7.329. Their mean Bone Mass Index (BMI) was 19.4600 with a standard deviation of 2.56840. In the Pelvic Tilt Control Stretching group, the mean age was slightly lower at 22.84 years, with a standard deviation of 1.724 and a p-value of 0.127 for age difference. The average height and weight for this group were 163.16 cm and 54.32 kg, with standard deviations of 4.819 and 7.554, respectively. The BMI mean for this group was 20.3920, with a standard deviation of 2.58472.

Table 1 Comparative Demographics

Study Group	Variables	Mean	Std. Deviation	p-value
Passive Straight Leg Raise (SLR)	Age of the Participants	23.00	1.848	0.078
	Height of the Participants	161.48	4.063	
	Weight of the Participants	50.70	7.329	
	Bone Mass Index of the Participants	19.4600	2.56840	
Pelvic Tilt Control Stretching	Age of the Participants	22.84	1.724	0.127
	Height of the Participants	163.16	4.819	
	Weight of the Participants	54.32	7.554	
	Bone Mass Index of the Participants	20.3920	2.58472	

Lifestyle habits of the participants, as outlined in Table 2, showed that in the Passive SLR group, 32.0% (8 participants) led an active lifestyle, while a majority of 68.0% (17 participants) had a sedentary lifestyle. Similarly, in the Pelvic Tilt Control Stretching group, 28.0% (7 participants) were categorized under active lifestyle, and 72.0% (18 participants) under sedentary lifestyle.

Table 2 Comparative Lifestyle

Study Group	Lifestyle	Frequency	Percent
Passive Straight Leg Raise (SLR)	Active Lifestyle	8	32.0%
	Sedentary Lifestyle	17	68.0%
Pelvic Tilt Control Stretching	Active Lifestyle	7	28.0%
	Sedentary Lifestyle	18	72.0%

Table 3 Comparative Active Knee Extension

Study Group	Measurement	Mean	Std. Deviation	p-value
Passive Straight Leg Raise (SLR)	Active Knee Extension Pre-Treatment	132.3600	6.13650	0.872
	Active Knee Extension Post-Treatment	138.4400	6.11746	
Pelvic Tilt Control Stretching	Active Knee Extension Pre-Treatment	132.3600	8.56777	0.000
	Active Knee Extension Post-Treatment	143.9600	8.66256	

Table 3 provided insights into the effectiveness of the treatments. In the Passive SLR group, the mean pre-treatment active knee extension was 132.3600 with a standard deviation of 6.13650, and the post-treatment mean was 138.4400 with a standard deviation of 6.11746. The p-value for the pre-treatment measurement was 0.872, indicating no significant change. In contrast, the Pelvic Tilt Control Stretching group showed a notable improvement. Their pre-treatment mean for active knee extension was 132.3600 with a standard deviation of 8.56777, and the post-treatment mean significantly increased to 143.9600, with a standard deviation of 8.66256. The p-value for the pre-treatment measurement in this group was 0.000, signifying a statistically significant change.

DISCUSSION

The findings of this study provide significant insights into the immediate effects of passive SLR and pelvic tilt control stretching on hamstring tightness in asymptomatic young females, a demographic primarily composed of students and recent graduates. The age

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range for inclusion was set between 20 to 30 years, reflecting a high prevalence of hamstring tightness in this group, potentially due to prolonged sitting habits associated with studying and reading.

Interestingly, the Bone Mass Index (BMI) measurements revealed that most subjects fell within the normal range, with none categorized as obese, although many were underweight, the lowest BMI recorded being 15. This study also highlighted a predominant sedentary lifestyle among participants, with 68% leading such a lifestyle, which likely contributes to reduced hamstring flexibility. However, it's notable that 32% of the females, despite leading an active lifestyle, also exhibited hamstring tightness.

Previous studies have shown a moderate association between hamstring length, measured by passive knee extension with hip flexion at 90 degrees, and the lumbar curve of approximately 12 degrees. This aligns with the concept that tight hamstrings may correlate with an increased lumbar curve in a standing posture. Our study reinforces this link, demonstrating that short hamstrings are associated with an increased lumbar curve in standing.

A key distinction of our study is the use of the active knee extension test, also known as the 90/90 test, as the primary outcome measure. This test specifically assesses hamstring extensibility, minimizing the influence of other muscle functions, unlike other studies that predominantly utilized the SLR test. Employing the active knee extension test enhances the study's authenticity by providing more accurate readings of hamstring tightness, measured using goniometry (13,16).

Our findings are in line with previous research indicating that tight hamstring muscles can diminish hip flexion range of motion during movement (18). A recent study reported that the posterior thigh muscles, including the hamstrings, limit hip flexion range during forward trunk bending when the knees are extended (19-21). In our study, the independent sample test post-treatment readings of the active knee extension test showed significant results, demonstrating the effectiveness of the interventions.

However, this study is not without its limitations. The sample size and demographic focus on young females may limit the generalizability of the results. Moreover, the study's design as a quasi-experimental trial implies certain constraints in establishing causality. Future research could benefit from a more diverse demographic sample and an expanded age range to enhance the applicability of the findings. Additionally, incorporating a longitudinal design could provide insights into the long-term effects of these stretching techniques on hamstring flexibility.

This study contributes valuable data to the understanding of hamstring tightness in young females and the effectiveness of passive SLR and pelvic tilt control stretching interventions. The findings underscore the need for further research in this area, particularly studies that address the identified limitations and build upon the foundational knowledge established here.

CONCLUSION

In conclusion, this study underscores the effectiveness of both passive SLR and pelvic tilt control stretching in improving hamstring flexibility in young, asymptomatic females, a demographic particularly prone to hamstring tightness due to lifestyle factors. The findings have important implications for physical therapy practices, suggesting that targeted stretching interventions can be beneficial in addressing hamstring tightness in this population. Moreover, the study highlights the need for awareness and preventative measures in daily routines, especially for those leading sedentary lifestyles, to enhance overall muscle flexibility and reduce the risk of related musculoskeletal issues.

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