



EFFECT OF HAMSTRING TIGHTNESS ON DYNAMIC BALANCE IN YOUNG FEMALES AGED 19-25 YEARS

Physiotherapy

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ABSTRACT

Aim of the study- To compare the dynamic balance in young females with normal Body Mass Index (B.M.I.) with and without hamstring tightness. **Method-** It was a cross-sectional, comparative study. 22 young females were included in the study. Hamstring tightness was assessed using the Active Knee Extension (AKE) Test and based on the values; subjects were divided into 2 groups- Group A (with tightness) and Group B (without tightness). Star Excursion Balance Test (SEBT) was used to assess the dynamic balance in subjects from both groups. The data was analysed results were compared using appropriate statistical tools. **Result-** The study showed that star excursion balance test values were more in the group without tightness (p -value < 0.0012) as compared to the group with tightness. **Conclusion-** Dynamic balance as measured by star excursion balance test is better in subjects without hamstring tightness as compared to subjects with hamstring tightness.

KEYWORDS

Hamstring tightness, dynamic balance, young females

INTRODUCTION

The hamstring muscles namely semitendinosus, semimembranosus, biceps femoris and ischial head of adductor magnus form the muscles of the posterior compartment of the thigh. They originate mainly from the ischial tuberosity of the pelvis and continue downwards to insert on the tibia and fibula. Primary action of the hamstrings is to flex the knee and they also assist in extension of the hip. Along with these actions, by virtue of their two-joint attachment, the hamstrings play an important role in the stabilization of body posture, mainly the trunk and lower extremities especially during activities such as standing, walking, running, etc.¹

Balance refers to an individual's ability to maintain their center of gravity within their base of support. There are two types of balance-static balance which refers to the ability to maintain equilibrium when the individual is stationary and dynamic balance which is the ability of an object to balance while in motion or switching between positions. Good dynamic balance is essential for the effortless performance of the ADLs and self-care activities and also recreational activities. Due to its two-joint attachment, tight hamstrings draw the pelvis into posterior tilt and reduce the lumbar lordosis. Reduced flexibility of the hamstrings may also have negative impacts on the function and biomechanics of the knee and hip joints and the lumbo-pelvic rhythm and cause dysfunction and postural abnormalities². Considering the spine alignment, during daily activities, studying the effect of changes in the lumbar curvature on postural stability and balance is of great importance. Several studies indicate that there is increased postural instability in patients with low back pain due to changes in spinal muscle strength, coordination and change in the center of gravity during ADLs. Since hamstrings have a definite effect on pelvic tilt and lumbar spine curvature tightness of this muscle may have indirect effects on postural stability and balance³.

METHODOLOGY

The sample size was calculated using OpenEpi free source calculator and results obtained with the pilot study done on 10 individuals with and 10 individuals without tightness. Minimum obtained sample size for each group is 11. Hence, total sample size = 22

22 females were recruited from the students of K J Somaiya College of Physiotherapy. **The eligibility for inclusion criteria included-** Knee extension more than 20° short of full extension (Group A - with tightness) and knee extension within 20° of full extension (Group B - without tightness) measured using the Active Knee Extension Test, young females between the ages of 19-25, non-exercising females (not undergoing any athletic/fitness training program), females with B.M.I. between 18.5 - 22.9 kg/m^2 and females willing to participate. **The eligibility for exclusion criteria included-** Females with any musculoskeletal and/or neurological involvement of the spine and/or extremities, females with any vestibular dysfunction and professional athletes.

PROCEDURE

Approval from Institutional Ethics Committee was obtained. A written consent was taken from the subjects after explaining the details of the study. Subjects who were willing to participate in the study were included. Demographic characteristics of the subjects were noted. Body Mass Index was evaluated to check if the participants fall in the normal B.M.I. category (18.5 - 22.9 kg/m^2).⁴ Active Knee Extension Test was performed to evaluate for hamstring tightness. After performing the Active Knee Extension Test, the participants were divided into 2 groups – group A (with tightness) and group B (without tightness). Star Excursion Balance Test was performed on the participants from both the groups. Average of reach distances was taken for the right and left lower extremities.



STATISTICAL ANALYSIS

The data was entered using Microsoft excel and analyzed using GraphPad InStat 3.10 statistical software.

Kolmogorov-Smirnov test was used to check the Normality of the data. Unpaired t-test with Welch correction was used for the data which passed the test of normality and Mann-Whitney U test was used for the data which did not pass the test of normality. The level of significance was set as 0.05 for all analysis.

RESULTS AND ANALYSIS

The study showed that star excursion balance test values were more in the group without tightness (p -value < 0.0012) as compared to the group with tightness.

Table 1- Mean and standard deviation of variables of group A (with tightness)

VARIABLES	MEAN	STANDARD DEVIATION	PASSED TEST OF NORMALITY
AGE (years)	22.36	1.026	Yes
BODY MASS INDEX (kg/m ²)	20.67	1.374	Yes
ACTIVE KNEE EXTENSION (degrees)	45.18	5.240	Yes

Table 2- Mean and standard deviation of variables of group B (without tightness)

VARIABLES	MEAN	STANDARD DEVIATION	PASSED TEST OF NORMALITY
AGE (years)	22.63	1.026	Yes
BODY MASS INDEX (kg/m ²)	20.63	1.903	No
ACTIVE KNEE EXTENSION (degrees)	45.18	5.240	No

Table 3- Comparison of reach distances between group A (with tightness) and group B (without tightness).

REACH DIRECTION	MEAN	STANDARD DEVIATION	p-value	SIGNIFICANCE
ANTERIOR GROUP A GROUP B	103 114.90	7.855 4.872	0.0006	Extremely significant
ANTERO-MEDIAL GROUP A GROUP B	105.95 117	6.479 7.075	0.0012	Very significant
MEDIAL GROUP A GROUP B	106.62 113.20	6.238 8.933	0.0012	Very significant
POSTERO-MEDIAL GROUP A GROUP B	98.54 104.27	4.310 9.540	0.0012	Very significant
POSTERIOR GROUP A GROUP B	88.79 99.45	8.206 5.391	0.0012	Very significant
POSTERO-LATERAL GROUP A GROUP B	80.86 93.13	8.250 6.746	0.0012	Very significant
LATERAL GROUP A GROUP B	76.58 90.41	11.255 8.777	0.0012	Very significant
ANTERO-LATERAL GROUP A GROUP B	92 104.375	9.065 5.653	0.0012	Very significant

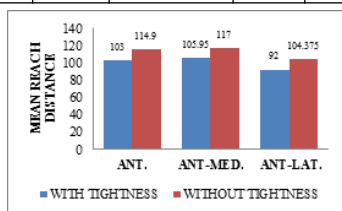


Figure 1- Comparison of anterior, antero-medial and antero-lateral mean reach distances between group A (with tightness) and group B (without tightness).

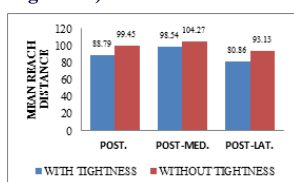


Figure 2- Comparison of posterior, postero-medial and postero-lateral mean reach distances between group A (with tightness) and group B (without tightness).

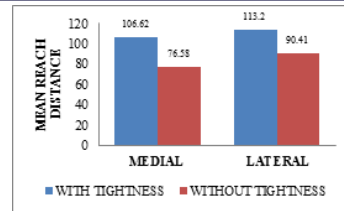


Figure 3- Comparison of medial and lateral mean reach distances between group A (with tightness) and group B (without tightness).

DISCUSSION

Hamstring muscles are one of the most important group of muscles owing to its two-joint attachment and the role that they play in stabilizing the body posture during dynamic activities. Flexibility of hamstrings is considered an essential element of normal biomechanical function of the pelvis, hip, and knee joints. Reduction in flexibility of the hamstrings leads to high risk of recurrent injury and decreases the ability to perform ADLs.

Many ADLs require good dynamic balance. Dynamic balance is required for normal daily activities such as walking, running, stair climbing, getting in and out of buses, trains, etc. sports activities also require proper balance.

The SEBT is a dynamic test that requires strength, flexibility and proprioception. The type of movement required during the SEBT is both multi-limb and multi-articular. Goal of the SEBT is to force subjects to disturb their equilibrium to a near maximum and then return to the state of equilibrium.^{9,10}

The ability to maintain balance during routine daily activities and exercises is an important factor in preventing injury. Any disturbance in the balance pattern can decrease performance and increases the likelihood of injury to the body. Muscle tightness is one of the most common motor system factors which affect the balance of an individual, the hamstrings being no exception. One of the most important muscles in the hip and ankle strategy is the hamstring muscle, which, as a postural muscle maintains balance by shift modification of the center of gravity position. Therefore, it seems that any dysfunction of the hamstring muscles can affect balance. It is logical that a decrease in balance can reduce the performance of the individual and cause injury.

A study done by Yasuhiro Endo et al⁸ proved that hamstring tightness is significantly correlated with medial reach distance on SEBT in junior high school basketball players.

A similar study done by Chaitali Shah¹¹ proved that hamstring and calf muscle tightness shows highly negative correlation with static dynamic balance.

Similarly, Zagyapan et al¹² showed in their study that hamstring shortness causes postural changes that affect balance.

The positive correlation between hamstring tightness and dynamic balance suggests that as hamstring tightness increases, the reach distance decreases.

By proving this positive correlation between hamstring tightness and dynamic balance, it has been made clear that individuals with hamstring tightness are more prone to balance problems and this may hamper their ADLs.

CONCLUSION

Dynamic balance was better in females who did not have hamstring tightness as compared to females who had hamstring tightness.

During the current situation of Covid-19 pandemic, sedentary lifestyle of the students and reduced working hours has led to an increase in occurrence of hamstring tightness among these students due to the continuous sitting postures. Hence, this study holds great social relevance. Further interventional studies can be aimed at increasing the hamstring flexibility and checking its effect on the dynamic balance. A similar study can also be performed on different populations such as athletes, geriatrics, etc.

Conflicts of interest: Nil.

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