Original Article

Quantify and Influence of Age on Hamstring Tightness in apparently Healthy 5 to 59 years old population

Moorthy AS[1], Karthikeyan T[2], Preeti Singh[3]

[1] Physiotherapist
PN Apex Trauma Centre
All India Instutitute of
Medical Sciences, New Delhi.
[2] Physiotherapist
National Institute of Mental Health
and Neuro Sciences, Bangalore.
[3] Physiotherapist
Six Face Physiotherapy Centre
New Delhi.

CORRESPONDENCE:

A.S.Moorthy
Physiotherapist
JPN Apex Trauma Centre
All India Instutitute of
Medical Sciences
New Delhi, India.
E-mail: aiimsmoorthy@gmail.com

ABSTRACT

Objective: Influence of age on hamstring tightness in apparently healthy individuals

Design: Experiment Design.

Subjects: 360 healthy individuals.

Measurements and Intervention: 360 healthy individuals were divided into 6 groups and their hamstring tightness was checked and they were compared.

Main Outcomes Measure: Hamstring muscle tightness.

Results: The data was analyzed using Independent test, ANOVA and paired test. ANOVA was used to compare left and right hamstring tightness between Group 1, 2, 3, 4, 5 and 6. Independent test was used to compare left and right hamstring tightness between males and females. Paired t test was used to find out the difference between left and right hamstring tightness in all 6 groups (P value < 0.05) was considered significant.

Conclusion: The findings of this study suggest that hamstring tightness is present in early childhood and increases with age in apparently healthy subjects.

Key words: Hamstring muscle tightness, male and female.

INTRODUCTION

Muscle tightness is caused by a decrease in the ability of the muscle to deform resulting in a decrease in the range of motion at the joint on which it acts.[1] The term has also been to denote a slight to moderate decrease in muscle length; usually the movement in the direction of the elongating muscle is limited.[2]

Muscle tightness usually results from unadequate or improper rehabilitation following sustained muscle injury or low levels of physical activity in individuals. It could make the muculotendinous unit more susceptible to injury, increase resistance to various anatomical structures, which may lead to overuse syndrome.[3] It could also lead to some pathological conditions at the joint on which the muscle acts, especially on a muscle like the hamistring which passes over two joints.[4]

The hamstrings comprise three large muscles, namely semitendinosus, semimembranous and biceps femoris which originate from the ischial tuberosity. They are located in the posterior compartment of the thigh and span the hip and knee joints.[5]

Hence, they are extensors of the hip and flexors of the knee Rehabilitation professionals routinely assess hamstring muscle length (HML) in persons with injuries

to the nervous or musculoskeletal system such as hamstring muscle injury spinal cord injury, low back pain, or anterior knee pain.[19] Hamstring tightness may be measured using the active unilateral SLR test; passive unilateral SLR test; the sit and reach test, and the active knee extension test (AKET).[6] A part from being used to measure hamstring tightness, the SLR tests are also widely used as neurological tests; hence they do not give valid measures of hamstring tightness because of pelvic rotation that occurs during the tests.[20] The AKET measures hamstring tightness by the angle subtended by knee flexion after a maximum active active knee extension, with the hip stabilized at 90 degree.[7]

The testrest reliability coefficient for the AKET was reported to be 0.99 for both lower limbs and this has been attributed to the strict body stabilization method, the well-defined end point of motion and accurate instrument placement of the test, previous studies have defined hamstring tightness at different arbitrarily set levels of active extension lag. Some researchers have defined it as at least 15 degree loss of active knee extension while others have defined it as equal to or greater than 30 degree loss of active knee extension with the femur held at 90 degrees of hip flexion.[8]

There seems to be no general agreement on the level of active extension lag that should be regarded as hamstring tightness It has also been documented that maximum popcitial angle (180 degrees) is measureable from birth to age 2 years after which it decrease steadily to an average of 155 degrees by age 6 years, and then remains steadily.[15] Tight hamstring muscles increase the patellofemoral compressive force because of the increased passive resistance during the swing phase of ambulation and running.[9]

Hamstring tightness has been reported to be the cause of posterior pelvic tilt in reduced lumbar lordosis and exacerbation of existing pain in patients with low back pain.[10] It has been reported to play a role in different forms of lumbar inter – vertebral disc pathology.[11] It's occurrence has also been found to be signigicantly higher in Nigerian adults with low back pain than in those without low back pain.[12]

Based upon general joint range of motion data, a physical therapist could expect HML to vary between men and women, with women having greater HML than men. Furthermore, a clinician could reason that HML would diminish with an increase in age.[16] A review of the literature does not provide direct answers to these questions about HML, but, based on the literature, generalizations can be age is atrophy of muscle cell number.[13]

It has also been noted that the muscle tissue may become yellow due to deposition of lipofuscin pigment and increased fat cells, or grey due to increased amounts of connective (fibrous) tissue.[14]

The collagien tends to lose its elasticity with age, as well as does capillary blood supply, which ligaments, the collagen and water concentration may decline with age as the labile reducible collagen cross -links decrease, and non-reducible cross-links increase. So, we want to study whether these is any influence of age on hamstring tightness in healthy individuals? [17]

MATERIALS AND METHODS

Subject where selected on the basis of inclusion and exclusion criteria 6 groups were made each of 60 subjects. In group 1, subjects of 5-12 years of age where age taken. Group 2, include subjects of 13-19 years. Group 3, includes subjects of 20-29 years.

Group 4 include subjects of 30-39 years. Group 5, include subjects of 40-49 years. Group 6, include subjects of 50 – 59 years. Instruments used in the study were AKET apparataus, full circle goniometer, measuring tape, Velcro strap and stabilizing belt.

Procedure

360 apparemtly healthy individuals were recruited on the basis of inclusion and exclusion criteria. A consent form was made and sign by each subject before any procedure for subjects. Below 18 years of age consent was taken from their parents.

The aim and procedure of the study was explained to the subject and were allowed to withdraw from the study at any point of time. The age of the subjects was recorded as at last birthday to allow for consistency and Height, weight and limb length was recorded for each subject.

Protocol

The individuals who participated in study were assessed for inclusion and exclusion criteria. Subjects who were included in the respective groups were measured for age, height, and weight. For measuring limb length the subject was asked to lie down and then pelvis was squared. Squaring of pelvis was done by measuring both side ASIS. After squaring of the pelvis, Measurement was done by measuring Length from Anterior Superior Iliac Spine to medial Malleolus of same side.

Limb lengths of both limbs were measured. Individuals were assessed for hamstring tightness with AKET aparauts.[21] The apparatus was made by placing two vertical and one horizontal bars being attached with the couch where patient will be assessed. The subjects were made to lie supine on the examination couch. A pliable

Ganiometer was strapped to the knee by Velcro fasterners. The fulcrum if goniometer was placed over the lateral epicondyle of femur proximal arm was alighned with the lateral midline of the femur taking greater trochanter as the reference point.

The distal arm was aligned with the head of the fibula and lateral malleolus. Subjects were asked to bend the leg to be tested and the height of the crossbar was adjusted such that it was contact with the distal anterior aspect of the thigh. The range of hip flexion was measured using another ganiometer to ensure that it was 90 degrees.[22]

The 90 degrees crossbar horizontal prevent further flexion at hip. The subject actively held this position with the knee in flexion at the ankle in plantar flexion and was asked to extend a knee.[23] At the first point where myoclonus was noticed the subjects were asked to stop further extension.

The angle of knee flexion was observed on the ganiometer that was attached to the knee.[24] The extended leg was calculated by substracting knee flexion angle from 180 degree and was recorded as hamstring tightness. The same procedure was done for measuring the hamstring tightness of opposite extremely also.

STATISTICAL ANALYSIS

The desctiptive analysis was used for demographic variables like Age, Weight, Height and BMI, ANOVA was used to compare left and right Hamstring Tightness between Group1, 2, 3, 4, 5 and 6.

Independent t-test was used to compare left and right hamstring tightness between males and females. Paired t test was used to find our difference between left and right hamstring tightness in all 6 groups. (P value <0.05 was considered significant).

RESULTS

Between group comparison of right hamstring tightness. The mean right hamstring tightness and standard deviation for Group 1 was 40.69+2064 degrees, Group 2 was 36.91+4.89 degrees, Group 3 was 42.59+ 3.87 degrees, Group 4 was 43.64+2.64 degrees, Group 5 was 44.71+4.30 degrees, Group 6 was 53.11+2.88 degrees. The result showed significant difference between the group (f=117.69, p=.0001).

Post hoc (Bonferroni) pairwise comparison showed significant diffrences between Group 1 and Group 2 (p=.0001), Group 1 and Group 4 (p=.0001), Group 1 and Group 5 (p.0001) and Group 1 and Group 6 (p=.0001), Group 2 and Group 3, Group 2 and Group 4, Group 2 and Group 5, Group 2 and Group 6, Group 3 and Group 5, Group 3 and Group 6, Group 4 and Group 2 and Group 5, and Group 6. There was significant difference between Group 1 and Group 3 (p=.113).

Table 1: Between groups comparison of right hamstring tightness

Groups	Hamstring Tightness Right (Degrees)
Group 1 Mean = SD	40.69+4.05
Group 2 Mean +SD	36.91+4.89
Group 3 Mean+SD	42.59+3087
Group 4 Mean+SD	43.64+2.64
Group 5 Mean+SD	44.71+4.30
Group 6 Mean+ SD	53.11+2.88
F value	117.69
P value	.0001

Table 2: Post Hoc Pair wise comparison of right hamstring tightness between groups

Groups	P value
Group 1 / Group 2	.0001
Group 1/ Group 3	.113
Group 1 /Group 4	.001
Group 1 / Group 5	.0001
Group 1 / Group 6	.0001
Group 2 / Group 3	.0001
Group 2 / Group 4	.0001
Group 2 / Group 5	.0001
Group 2 / Group 6	.0001
Group 3 / Group 4	1.000
Group 3 / Group 5	.041
Group 3 / Group6	.0001
Group 4 / Group 5	1.000
Group 4/ Group 6	.0001
Group 5/ Group 6	.0001

Table 3: Between groups comparison of right hamstring tightness

Extremity	Female N= 209 Mean+SD	Male N=151 Mean +SD	T value	P value
Hamstring Tightness left (Degrees)	42.85+6.24	44.66+6.11	2.727	.007
Hamstring Tightness left (Degrees)	43.87.+67.23	45.60+6.09	2.631	.009

DISCUSSION

The result showed that hamstring tightness was present in all age groups studied and that it tended to increase with age. [25] However, there was no significant diffrence in hamstring tightness in subjects in age groups 5-12, 20-29, 30-39, 40-49. In age age groups 40-49 and 50-59 years, hamstring tightness was higher than that for any of the younger age groups.[26]

It was significantly higher in age groups 50-59 years when compared with age group 40-49 years. These findings suggest that in this environment, hamstring tightness occurs in early childhood and it tends to increase with age.[27]

Except in group 13-19 the reason for that could be highest involvement of sports activity in this group which may the important factor for such variation in the results. However, it does not significantly increase until the 30-49 years age range, after which it seems to fall.[31] This corroborates the obsevations that hamstring tightness in juveniles is less than that in adults.[28]

The progressive decline in flexibility with age has been attributed to changes in elasticity and decreased level of physical activity.[29] Results also showed that males recorded higher values of hamstring tightness compared to their female counterparts across the age groups. This supports the finding that females of most ages have greater trunk/hip flexibility than males.

Right side hamstring tightness is significantly higher than that of the left side hamstring tightness this result is correlated with the previous research which stated that the tightness in the dominant limb us always higher than the non-dominant limb.[30]

We were able to support our hypothesis that there is a stastistically significant effect of gender on hamstings Muscle length (HML), with women having more HML than their male conterparts for both dependent measures examined in previous study Men have approximately 8 degree less passive strainght Leg Raise (PSLR) than women, and 11 degree less PA than women. Gajdosik et al reported that PSLR is the clinical test most often used to assess HML.[17]

According to Kendall et al the resulting angle between the longitudinal axes of the trunk and thigh should be about 80 degree for HML to be considered normal. However, Kendall et al appear to have based this HML estimate on clinical observations rather than original data gathered from a cohort of healthy persons. Additionally, Kendall et al assume that the 80 degree value should be identical for both men and women.[29]

It has been purported that the decrease in joint range of motion and muscle flexibility with aging may mechanical characteristics of collagen at the cellular level. Moreover, the loss of joint range of motion of muscle flexibility is likely multifactorial and also influenced by a generalized decline in activity level suspersions age.

Limitation of Study

- Effect of hamstring length on hamstrings tightness is not considered.
- Level of physical activity was not taken in to account.

Scope for Further Study

Association of hamstring muscle length and limb length with hamstring tightness can be found.

CONCLUSION

The findings of this study suggest that hamstring tightness is present in early childhood and inreases with age in apparently healthy subjects.

CONFLICT OF INTEREST:

The authors declared no conflict of interest.

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Ethical Clearance: It has obtained from Institute review board

REFERENCES

1. Zchezeweski IE. *Improving flexibility, in physical therapy.* Sally RW and Barnes MR (Eds.) Philadephia: JP Lippincott Co. 1989; 698-699.
2. Gossin MR, Sahraman SA, Rose SJ. Review of length – associated change in muscle. *Physical therapy.* 1982; 62;1799-1807.
3. Bohannon RW. Effect of repeated 8 minutes loading on the angles of straight leg rising. *Physical therapy.* 1984; 1697-1997.
4. Davies JG, Malone T, Basset FH. Knee examination. *Physical Therapy.* 1980; 60:15651573.
5. Moore KL, Lower limbs. *Clinically Oriented Anatomy.* 3 Edition. Baltmore: William and Wilkins, 1992; 421-423.
6. Markos PD. Ipsilateral and contra lateral effects of propriceptive neuromuscular facilitation technique on hip motion and electromyography activity. *Physical Therapy.* 1979; 59:1366-13.36.
7. Magee DJ. *Orthopedic Physical Assessment.* 4th ed, Philadelphenia, PA; Saunders; 2002.
8. Irvin R, Invesrsen D, Roy S. *Sports Medicine:* Prevention Assessment, Management, and Rehabilization of Athletic Injuries, 2nd ed. Boston, MA; Allyn & Bacon: 19.
9. Somers MF. *Spinal Cord Injury;* Functional Rehabiliation. 2nd ed, Upper Saddle River, NJ; Prentice.
10. O 'Neil DB, Micheli LJ, Warner JP. Patello femoral stress, A prospective analysis of exercise treatment in adolescens and adults. *Am J Sports Med.* 1992; 20;151.56.
11. Esola MA, McClure PW, Fizgerald GK, Siegler S. Analysis of lumber spine and hip motion during forward bending in subjects

with and without a history of low back pain. *Spine.* 1996; 21: 71-78.

12. Norkin CC, White DJ. *Measurements of Joint Motion.* A Guide to Goniometery. 3rd ed. Phildelphia, PA; FA Davis Co, 2003.
13. Recese NB, Bandy WD. *Joint Range of Motion and Muscle Length Testing,* Philadephia, PA;WB Saunders Co;2002.
14. Moore MA, Hutton RS. Electomyography investigation of muscle stretching technique. *Med Sci Sports.* 1981; 12:322-329.
15. Chung PK, Yuen CK. Criterion related validity of sit-and reach test in university women. *Hong Kong Perpectual and Motor Skills*. 1999; 88(1):304-316.
16. Bohannon RW. Cinematigraphic analysis of the passive straight leg raising test for hamstring muscle length. *Physical therapy.* 1982; 62:1269-1274.
17. Gajdosik RL, Lusin G. Hamstring muscle tightness: Reliability of an active knee extension test. *Physical therapy.* 1983; 63:1083-1090.
18. Webright WG, Randolph BJ, Perrin DH. Comparison of non-ballistic active knee extension in neural slump position and static stretch techniques on hamstring flexibility. *J Ortho Sports Physical therapy.* 1997; 26(1):7-13.
19. Bendy WD ,Irion JM, and Bigger M. The effect of time and frequency of static stretch on flexibility of the HAMSTRING muscle. *Physical therapy.* 1997; 77:1090-1096.
20. Kuo L, Chung W, Bates E, Stephen J. The hamstring index. *J Ped Orthopedics.* 1987; 17(1):78.
21. Bohannon RW. Effect of repeated 8 minutes loading on the angle of straight leg rising. *Physical therapy.* 1984; 64:491497.
22. Christine E. Back pain re visited. *J Ortho Sports Physical therapy.* 1987; 8(12):230-234.
23. We Mares WS. Flexibility and velocity of the normal and impaired lumbar spine. *Archieves Phys Med Rehab.* 198; 67:1865-1869.
24. Wendell L Unresolved controversies in back management kumbar spine. *Physical therapy.* 1988; 9(7): 1213-1216.
25. Fielding RA. Symposium on 'Nutrition for the Elderly.' *Proceedings of the Nutrition Society.* 1995; 54:665+675.
26. Timiras PS. *The physiological basis of aging and geriatrics.* 2nd ed. CRC Press BocaRaton, 1994.
27. Kisner C. *Therapeutic exercise: foundation and techniques.* 2nd ed, 1990, FA Davis, Philadelphia 4; 122-123.
28. Buckwalter JA, Woo SL, Goldberg V M et al. Soft tissue aging and muscluloskeletal finction. J Bone Joint Surg. 1993; 75a:1533e.
29. Kendall FP. *Muscles: Testing and function.* 3rd ed. Baltimore: William & Wilkins, 1983.
30. Wang SS, Whitney SL, Burdett RG. Lower extremily muscular flexibility in long distance runners. *J Orthorp Sports Phys Ther.* 1993; 17(2):102-7.
31. Subotnick SI. Low back pain from functionally short. *Podiatry Assoc.* 2001; 71; 42 1981.