Original Article

Physiotherapy and Occupational Therapy Journal
Volume 16 Number 2, April - June 2023
DOI: http://dx.doi.org/10.21088/potj.0974.5777.16223.1

Comparison between Hamstrings Stretching Alone Versus Stretching and Neural Mobilization for Subjects with Moderate to Severe Hamstrings Tightness

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How to cite this article:

Mohammed Aslam/Comparison Between Hamstrings Stretching Alone Versus Stretching and Neural Mobilization for Subjects with Moderate to Severe Hamstrings Tightness/Physiotherapy and Occupational Therapy Journal. 2023;16(2): 67-74.

ABSTRACT

60 Patients included in the study as per inclusive and exclusive criteria. Subjects were included after the ethical committee approval. Informed consent obtained to conduct the study. Subjects were randomly divided in to three groups Group A, Group B and Group C with 20 subjects in each group. Group A and B assessed for neural and contralateral neural mobility and Group C assessed for hamstrings mobility. Four weeks interventions had given to each groups. Group A had given Hamstrings stretch + neural mobilization, Group B had given Hamstring stretch + contralateral neural mobilization, Group C had given Hamstring stretch. Five subjects dropped out, 2 males from Group A and 3 males from Group B. All the subjects reassessed by active knee extension test. Mean of the readings taken for final analysis. Results were calculated using 0.05 level of significance. When comparing the pre and post intervention hamstring mobility between the Group A, B and C results, it was found that hamstring mobility increased more in Group A as compared to Group B and C. From this we can infer that ipsilateral neural stretch accompanied with hamstrings stretch releases ipsilateral hamstrings restriction more compared to contralateral neural stretch accompanied with hamstrings stretching and isolated hamstrings stretch.

Keywords: Hamstrings; Stretching; Mobilization; Muscle tightness; Physical exercise.

INTRODUCTION

Evaluation of posture can be an integral part of physical assessment before both physical exercise and exercise prescription. Whole body assessment has been shown to reveal distinct posture types but local muscle tests are required to highlight specific muscle length changes.[1] Hamstring muscle tightness has been described as integral to the lordotic posture type. The tightness of the hamstring muscle is traditionally been measured using the SLR test. However the movement of the pelvis in this test make the test less specific to the hamstring and therefore raises questions of the appropriateness and reliability, in addition this test has been described as potentially more useful as a neurological test rather than muscle length test in a clinical setting.[2] The active knee extension test involve the movement at the knee joint but not the hip. While the SLR involves movements of both the hip and knee joint making it more difficult to

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Recieved on 29.04.2023

Accepted on 31.05.2023

control. Active knee extension (AKE) test is often used to measure the hamstring tightness as a part of the orthopaedic physical assessment with normal values of knee motion to within 20 degrees of extension lag being quoated.[1,2,4] AKE test is a measure of hamstring muscle length in a position of hip flexion similar to running and kicking activities. During this test hip is maintained at 90 degree of flexion and at the participant's limit of knee extension, the angle between the vertical and the tibia is recorded using an inclinometer.[5] Hamstrings are commonly injured muscles in athletic activities. Numerous investigations have been conducted to identify the causes of this frequently occurring injury. Most studies have concluded that lack of hamstring flexibility contributes to lower extremity injury. Although most researchers and clinicians agree that hamstring flexibility plays an important role in injury, there is a lack of agreement as to what is the most effective way to lengthen the hamstring group. Techniques previously investigated for improving hamstring flexibility include static stretching, exercise, heat, massage, and proprioceptive neuromuscular facilitation.[9] It was pointed out that along with the hamstrings, the deep fascia of the lower limb and the soft tissues of the pelvis, including neurologic tissue limit a straight leg raise test. In the same way, these non-contractile tissues can come under tension during passive or active movements of hip flexion or knee extension. If tension of non-contractile tissue limits indirect measures of hamstring flexibility, i.e. straight leg raise or active knee extension tests, then use of a stretching technique that emphasizes these tissues, along with the hamstrings, may be justified.[7] Maitland implicated the loss of movement of the dura matter and nerve roots sleeves within the vertebral canal as the cause of limited knee extension and ankle dorsiflexion range of motion during slump.[7] A neurodynamic test is a sequence of movements designed to assess the mechanics and physiology of that part of the nervous system by elongation of the nerve.[4] While trying to control all the elements of this test, clinicians may ask the patient to actively extend the knee to increase tension to the neural component. To check the hamstrings length the test is performed in the sitting position and the participant shall be asked to fully flex the cervical spine followed by thoracic and lumbar spines, then ankle dorsiflexion is added up and the participant extends the knee until a stretch or discomfort is felt. In this position the angle between the horizontal and the tibia is measured using the inclinometer.[5] Previous studies had investigated the measurement error and the reliability of measurements within trials on a single day and across days of knee AROM in a modified slump test position involving increased hip flexion, but these studies showed no significant differences across a two day interval.[4] Researchers examined the effect of neural tension producing movement of the cervical spine and lower extremity on knee extension ROM during the slump test. But the results indicated that limitations in knee terminal extension ROM may be considered as a normal response to the inclusion of cervical ROM, ankle dorsiflexion, medial hip rotation in the slump test in young healthy males.[3] A number of positive tests for both the upper limb neural tension test and the seated slump test was found to be high in the sample of asymptomatic healthy young adults.[6] Previous studies comparing the effect of non ballistic repetitive active knee extension movements performed in a neural slump sitting position with that of static stretching technique on hamstring flexibility showed no specific differences in uninjured subjects.[7] Structural differentiating maneuvers have a significant effect on neurodynamic test response in terms of range of movement even in normal asymptomatic individuals. These normal neurogenic responses to lower quadrant neurodynamic testing should be taken into account during the assessment clinical reasoning process, to avoid the development of management plans based on a false positive test result.[8] Contralateral movements of the nervous system can produce fascinating occurrences.[14] When a neurodynamic test is held stationary and same test is performed on the contralateral limb, the symptoms in the held limb often subside.[14] The cervical and lumbar nerve roots diverge from the spinal cord at an angle.[34] As the contralateral neurodynamic test is performed, forces enter the spinal cord through the contralateral nerve roots. The downward movement of the cord is most likely small but is sufficient to transmit a reduction of tension through ipsilateral held nerve root.[14]

METHODOLOGY

Sample

A total of 55 subjects (48 males and 7 females) participated in the study. All the subjects were recruited from different hospital of Dehradun.

Inclusion Criteria

- Age between 20-35 years.
- Both male & female subjects were included.
- Asymptomatic individuals.

- Subjects with moderate to severe hamstrings tightness.

Exclusion Criteria

- History of knee trauma.

- Any causes of immobilization of lower extremity.

- Neurological condition affecting lower extremity.

- Lower limb fractures.

- Hip and ankle joint pathologies.

- Knee stiffness.

- Moderate to severe plantar flexor tightness.

Study Design

- Experimental study.

Instrumentation

- Digital inclinometer (Baseline Digital 12-1057).

- Mulligan belt.

- Ankle foot orthoses (Fabricated).

Mulligan belt, digital inclinometer and ankle foot orthoses

Quadriceps table

- Quadriceps table (Biomed India).

Protocol

Based on inclusion or exclusion criteria subjects were recruited in the study. Assessment of hamstring tightness and neural mobility (slump test) was done initially for all the subjects. Three readings were taken with the help of a digital inclinometer and their mean was recorded. All subject were randomly divided into three group *i.e.* Group A, B and C by simple randomization. Group A was intervened with hamstring stretching and contralateral neural mobilization with ipsilateral knee in 900. Group B was intervened with hamstring stretching and contralateral neural mobilization with ipsilateral knee in extension. Group C was intervened with hamstrings stretching alone. Intervention was given for a period of four weeks for all the subjects. Pre intervention and post intervention readings were included for the final analysis.

RESULT

60 subjects with knee extension lag more than 35 degrees in active knee extension test with hip and knee in 90-90 position were selected. Right lower extremity was chosen for the study. Ankle foot orthoses was fitted to both the extremities to stabilize the ankle joint at 0 degrees. Subject was positioned in a supine position and hip in 900, maintained by a stool, the ipsilateral limb was actively taken to knee extension. The knee extension lag was measured and recorded using an inclinometer. The foot was placed in an ankle foot or thoses at 00 during the procedure. Then a therapist took the opposite lower

Active knee extension test

extremity into knee extension until R2 was felt, this position of the opposite lower extremity was maintained by the therapist and subsequently the patient was asked to extend the reference extremity again and angles measured and recorded. All the subjects were divided into 3 Groups randomly. All the subjects underwent an intervention for 4 weeks, 7 days a week (5 days intervention and two days home programme) once a day. A contra-lateral neural mobilization with ipsilateral limb in 900 flexion and ipsilateral hamstring stretching protocol incorporated for Group A (experimental), contralateral neural mobilization with ipsilateral limb in terminal knee extension and ipsilateral hamstring stretching protocol Group B (experimental) and only ipsilateral hamstrings stretching protocol for Group C (control). During the intervention three drop outs were there. (2 male subjects from Group A and 3 male subjects from Group B) and the outcome measures were recorded again after the intervention using the already described method. The recordings were finally analyzed for difference between the Groups and influence of contralateral neural mobility within and between each Group.

Intervention

Group A. (Experimental group)

Subjects were positioned comfortably on a quadriceps table with pelvis as close to back rest as possible. Popliteal fossa of lower limbs was placed at the edge of the table in sitting position. Hip joint was positioned in 90 degree flexion. Thigh was also stabilized with belt to avoid lifting off thigh from the quadriceps table during procedure. Ankle joint was placed in zero degree plantar flexion with the help of ankle foot or thoses. Subject was asked to slouch as much as possible and maintain the posture through out the procedure. In this position subjects were asked to go for active knee extension on the opposite side maintaining the ipsilateral knee in 900 of flexion. Three sets of eight repetitions, once a day for four weeks, (five times weekly and two days home programme). To control spinal flexion, the subjects were instructed to flex the trunk maximally to a point where they perceived a tolerable stretch sensation in the spine but no pain. Maximal

Contralateral neural mobilization with ipsilateral limb at 90° flexion

spinal flexion was then maintained with a strap fixing the thoracic and lumbar spine into flexion perpendicular to the seat. For each test, the starting position was 90° flexion at the knee joint with the ankle in neutral. Ipsilateral hamstrings stretching will be given - three sets of three repetitions each with 20 seconds hold once a day (five times weekly and two days home programme).

Group B. (Experimental group)

Subjects were positioned comfortably on a quadriceps table with pelvis as close to back rest as possible. Popletial fossa of lower limbs was placed at the edge of the table in sitting position. Hip joint was positioned in 90 degree flexion. Thigh was stabilized with belt to avoid lifting off thigh from the quadriceps table during procedure. Ankle joint was placed in zero degree plantar flexion with the help of ankle foot or thoses. Subjects were asked to slouch as much as possible and maintain the posture through out the procedure. In this position subjects were asked to go for active knee extension on the opposite side maintaining the ipsilateral knee also in terminal knee extension. Three sets of eight repetitions, once a day for four weeks, (five times weekly and two days home programme). To control spinal flexion, the subjects were instructed to flex the trunk maximally to a point where they

Contralateral neural mobilizaton with ipsilateral active knee extension

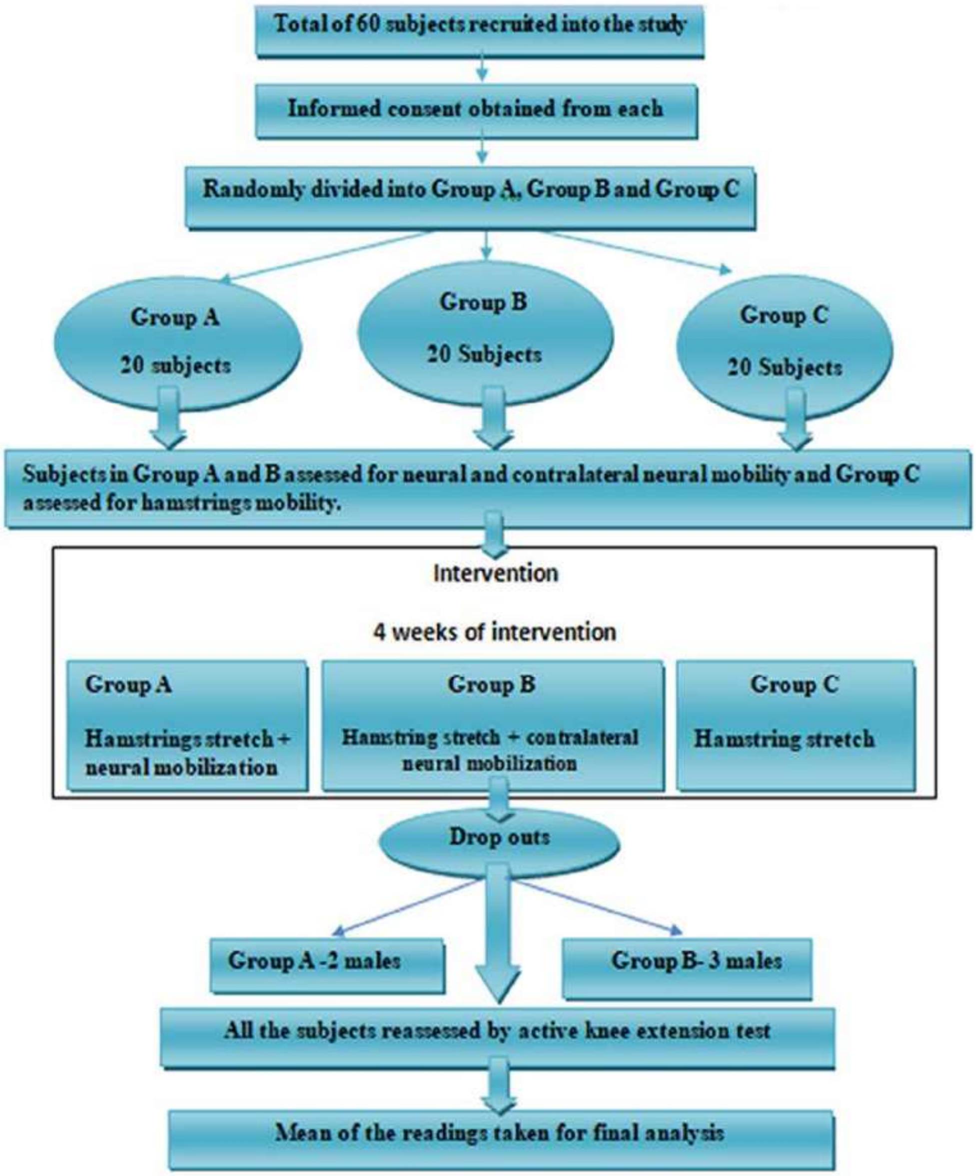
perceived a tolerable stretch sensation in the spine but no pain. Maximal spinal flexion was then maintained with a strap fixing the thoracic and lumbar spine into flexion perpendicular to the seat. For each test, the starting position was 90° flexion at the knee joint with the ankle in neutral. Ipsilateral hamstrings stretching was be given for three sets of three repetitions each with 20 seconds hold once a day (five times weekly and two days home programmed).

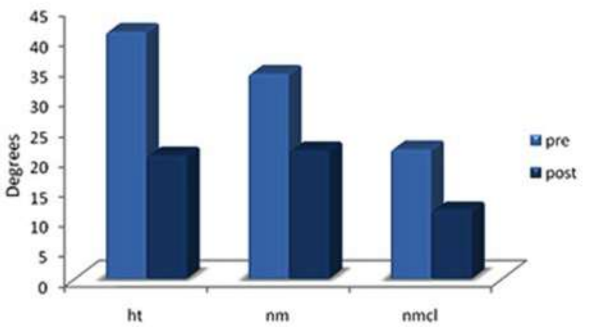
Group C (control)

Only ipsilateral hamstrings stretching were

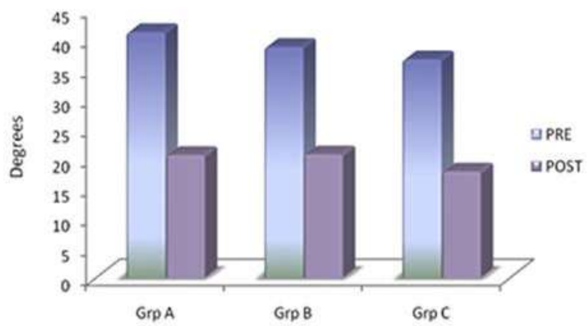
Isolated hamstring stretching

Flow chart for the procedure

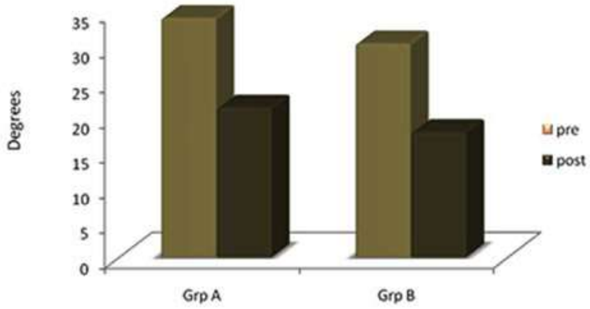




Group A: Comparison between pre and post intervention mean



Comparison of hamstring mobility between Group A, Group B and Group C.



Comparison of neural mobility between Group A and Group B.

incorporated as per the procedure described above.

DISCUSSION

In Group A when comparison was made between pre and post intervention with respect to hamstring mobility, neural mobility and contralateral neural mobility the active knee extension lag decreased. Within the Group A when comparison was made between pre and post intervention with respect to hamstrings mobility a significant increase in hamstrings mobility was found after the intervention. Within Group A neural mobility and contralateral neural mobility also increased after the intervention when assessed through active knee extension lag in both cases. Within Group B when comparison was made between pre and post intervention extension lags with respect to hamstrings, neural and contralateral neural mobility, a statistically significant increase was found after the intervention. From this we can infer that any loss of flexibility of not only the muscular structures but neural structures also contributes to active knee extension lag. Supporting this we found that when we individually stretched the neural and muscular components significant decrease in the lag was found after the intervention. It has been proved that static stretching of one repetition for 30 seconds three days per week increases hamstrings length in healthy subjects.[11] Six weeks of non ballistic repetitive active knee extension (30 repetitions twice daily) performed in a neural slump sitting position produces the same hamstrings flexibility as static stretching (30 second, twice daily).[7] It was proved that structural differentiating manoeuvres have a significant effect on neurodynamic test response in terms of range of movement even in normal asymptomatic individuals.[8] Progressive decreases in terminal knee extension ROM may be considered as normal response to the successive addition of cervical flexion, ankle dorsiflexion and medial hip rotation to the slump position in adult males without low back pain or injury.[3] The high prevalence of posterior lower extremity symptoms induced by the Slump test amongst asymptomatic subjects, which are relieved by cervical extension, suggests that neural structures may contribute to perceived hamstring tightness and the sensation of discomfort produced during hamstring stretches.[15] It was proven that knee extension AROM could be reliably measured across days in subjects without pathology and acceptable measurement error occurs.[4] From the results of our study we can hypothesize that active knee extension lag is a composite outcome measure for both neural and muscular structures and intervention involving neural and muscular components contributes in decreasing the lag. It is proven that musculo skeletal flexibility is well explained in mechanical terms rather than neural theories.[13] When the pre intervention and post intervention active knee extension lag in group C were compared our results revealed that hamstring mobility increased after hamstring stretching. This was found to be statistically significant. This could be because a proper stretch force directly stretched the connective tissue fibers of the muscles (endomysium and perimysium) and thus the effect.[12] Static tension placed on the muscle tendon unit has been shown to activate the GTO (Golgi tendon organ), which may produce autogenic inhibition of the muscle that is stretched. Static stretching has been shown to be very effective at increasing hamstring length.[11] When comparison of pre and post intervention neural mobility between Group A and B was done, results revealed that neural mobility increased more in Group A than Group B. This could be because contralateral mobilization must have stretched the dura which could have relieved the restriction in the ipsilateral nerve roots. The event of contralateral technique produces a change in symptoms in a limb that is held in neuro dynamic position constitutes evidence of neurodynamic mechanism to the symptoms. Treatment with contralateral neural mobilization is justified only if the technique produces improvement.[14] But since it was not found to be statistically significant we cannot predict this relationship. The pre and post intervention contralateral neural mobility was compared between the Group A and B results revealed that contralateral neural mobility increased more in Group B than Group A. This could be because in Group B ipsilateral hamstring stretch was followed by contralateral mobilization. The event of contralateral technique producing a change in symptoms in a position that is held in a neurodynamic position will constitute evidence of neurodynamic evidence to symptoms.[14] The dura and nerve roots could have been placed in a stretch and thus the effect. But since statistically significant difference was not found we cannot predict this relationship. When comparing the pre and post intervention hamstring mobility between the Group A, B and C results, it was found that hamstring mobility increased more in Group A as compared to Group B and C. From this we can infer that ipsilateral neural stretch accompanied with hamstrings stretch releases ipsilateral hamstrings restriction more compared to contralateral neural stretch accompanied with hamstrings stretching and isolated hamstrings stretch. Since neural structures may contribute to perceived hamstring tightness and the sensation of discomfort produced during hamstring stretches.[15] But statistically significant was not found so we cannot predict this relationship. Comparison of hamstring mobility between the Group B and Group C, it was seen that AKE lag decreased more in Group C than Group B. From this we can infer that contralateral neural mobility exercise could not affect hamstrings mobility. This was not found to be statistically significant so we cannot predict this relationship. When pre and post hamstring mobility was compared between Group A and C results showed that Group A was more effective. So we can predict that neural mobility exercise has some effect on hamstrings muscle mobility. But since it was not found to be statistically significant we cannot conclude this.

An increase in group hamstrings mobility was found when comparing the pre and post intervention hamstring mobility between Group A and Group B. From this we can infer that neural mobility exercise must have contributed to hamstrings mobility compared to contralateral neural mobility exercises, but was not found to be statistically significant so we cannot predict this.

CONCLUSION

It was found that hamstring mobility increased more in Group A as compared to Group B and C. From this we can infer that ipsilateral neural stretch accompanied with hamstrings stretch releases ipsilateral hamstrings restriction more compared to contralateral neural stretch accompanied with hamstrings stretching and isolated hamstrings stretch.

Future Research

Comparison could be made across two groups with ipsilateral and contralateral neural mobilisation. Same study could be done on different muscle groups.

Relevance to clinical practice

Neural mobilisation protocol should be considered along with hamstrings stretching to improve the knee extension range of motion in subjects with mild to moderate hamstrings tightness.

Limitations of study

Less number of female subjects were included into the study.

Source of Funding: Self

Ethical Clarence; It is bonafied work done by me and have not taken any part of thesis from any where.

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