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Effect Of Non-Ballistic Active Knee Extension In Neural Slump Position On Hamstring Flexibility

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Abstract

PURPOSE :- To assess how neural slump mobilization affects hamstring flexibility
BACKGROUND :- Thirty adult individuals in good health with restricted right hamstring flexibility (minimum of 15 degrees less active knee extension assessed with femur held at 90 degrees of hip flexion) were divided into two groups at random.
METHOD:- Subjects in Group A will engage in non-ballistic static stretching for 30 seconds, which will be followed by static stretching for 30 seconds after a 5-minute rest period for two weeks. Group-B: Over the course of two weeks, the subject will complete static stretches maintained for 30 seconds, repeated five times, with a 1-second break in between each stretch.
STATICAL ANALYSIS :- To compare the mean value for pre-treatment and post-treatment ROM across groups as well as the comparison of the mean values for pre-treatment and post-treatment ROM within the group, independent sample t-test and paired t-test were employed, respectively. A value of p was chosen.05
RESULT:- According to a within-group analysis, group A's mean range of motion was larger after therapy than it was before treatment (53.83 2.43), and this difference was determined to be statistically significant (p=0.00). The difference between the mean post-treatment range of motion value for group B (51.44 2.63) and the mean pre-treatment range of motion value (38.49 3.26) was determined to be statistically significant (p=0.00).
The results of the between-group analysis showed that group A's mean post-treatment range of motion value was greater than group B's (53.83 2.43 vs. 51.44 2.63), and this difference was judged to be statistically significant (p=0.016).
CONCLUSION :- The results of the current study showed that static stretching combined with the neural slump posture improved hamstring flexibility in adults more than static stretching alone,

	resulting in changes in the accuracy of the active knee extension measurement.
	Keywords: neural tension, stretch, active knee extension test, hamstrings.

INTRODUCTION

Stretching is the word used to refer to any therapeutic procedure intended to promote soft tissue mobility and, as a result, improve range of motion (ROM) by elongating structures that have become hypermobile and adaptively shortened. Flexibility is the capacity to move a single joint or a group of joints through an unconstrained, pain-free range of motion (ROM) [**1**].

Ballistic stretching, static stretching, contract relax stretching, and contract relax-agonist contract are the four fundamental stretching techniques listed by Moore and Hutton. The last two methods are known as the PNF method **[2]**. The muscle that has to be stretched is subjected to bouncing or jerking motions in the ballistic stretch. Logically, the uncontrolled extension beyond the muscle's extensibility limit that takes place during the ballistic stretch might harm the muscle. Therefore, there hasn't been much literature to support the usage of the approach**.[3]**

The term "static stretch" refers to a technique in which the muscle is gradually stretched to its maximum tolerable length (pleasant stretch, free of discomfort), and the posture is maintained with the muscle in that length. Compared to ballistic stretching, static stretching has benefits. It's extremely unlikely that anything will extend over the tissue's maximum extensibility range. Additionally, the approach uses less energy and reduces muscular pain. Although there is evidence to suggest that pelvic position during standing stretches is crucial, the extent of range of motion improvement was not significantly affected by the static stretching position (standing, sitting, or supine)**[4].**Due to the quantity of connective tissue, increased stiffness, and decreased elasticity that can occur with aging, low intensity and prolonged stretching techniques may improve gains in ROM in senior individuals**[5]** .Prior to a static stretch, the PNF technique of contract – relax and hold – relax uses a short isometric contraction of the muscle to be stretched. Stretching using PNF was more successful than static or ballistic stretching **[6,7,8]**. In addition to needing the greatest competence of the three approaches mentioned, the PNF technique also apparently requires an experienced therapist to deliver**.[3]**

A straight leg raise test may be restricted by the deep fascia of the lower limb, the soft tissue of the pelvis, including neurologic tissue, according to Gajdosik **[9,10,11].** Similar to how these non-contractile tissues might become tense during passive or vigorous hip flexion or knee extension movements. Use of a stretching technique that focuses these tissues together with the hamstrings may be warranted if the tensions of non-contractile tissue restrict indirect measurements of hamstring flexibility, such as the straight leg raise or active knee extension test**[,12].** Several neurodynamic tests, including the straight-leg-raise (SLR) test, have been proposed to evaluate the mechano sensitivity of neurogenic structures (Cyriax, 1942; Kennealy et al., 1988; Maitland, 1985). These tests were first intended to detect the existence of perineuritis. Using cervical flexion and ankle dorsiflexion, Maitland (1985) devised the slump test, which was thought to measure the mechanosensitivity of the neuromeningeal tissue within the spinal canal**[13].**The claims of (1942) and Maitland (1985) have been corroborated by studies (Adams and Logue, 1971; Brieg, 1978; Goddard and Reid, 1965), which show that spinal flexion in a cadaver model caused tension in the nerve roots and dural sleeve. Despite the fact that neurodynamic tests are frequently cited as having limited diagnostic value in distinguishing between neural and non-neural structures (Dia Fabio, 2001), recent research showed that slump stretching did not make pain of non-neural origin (experimentally induced) worse (Coppieters et al., 205). The authors argued that their study's findings supported the identification of abnormal neuro dynamics using neurodynamic tests, such as the slump**[13].**

Maitland described**[14,15]** a neural tension test (also known as a slump test), in which patients actively extend their knees while seated while retaining cervical and thoracolumbar flexion. This posture smoothly tenses the lumbosacral nerve root and spinal cord. In a flexed or slumped posture, there is a normal reaction of limited ankle and knee dorsiflexion range of motion, but complete range is only possible once cervical flexion is released and the head is raised back to its upright position **[16].**Rather than hamstring lengthened The restricted range of motion in the knee extension and ankle dorsiflexion during the slump maneurer was attributed by Maitland to the lack of flexibility of the dura mater and nerve root sleeves inside the spinal canal**[14]** The slump test sequence and its clinical use in the diagnosis and therapy of spinal dysfunction are well described by Maitland and Butler. Active knee flexion appears to be an efficient way to tighten hamstring and neural tissues while doing the neural slump test **[14].** The slump test was first described by Maitland (1985). Since then, it has been used as a tool for assessing potential changed neurodynamics and, more recently, as a potential therapeutic approach (Butler, 2000). Only case reports or case studies have been used to support the success of the slump test as a therapy strategy, and there isn't much data to back this up (Cleland et al., 2004; Cleland and McRae, 2002; George, 2000) **[11]**

In order to test the theory that patients who got static stretching in addition to slump stretching would see larger increases in hamstring flexibility than patients who received static stretching alone, we arranged this study.

Materials and Methods :-

A total of 60 healthy students volunteered to participate. Every participant was either a student or a member of a faculty at deemed university Ghaziabad, Uttar Pradesh who was orally invited to participate in the experimental study. The mean age , weight of group A were (22.46±2.72) yr and (56.66± 7.81) kgs . The mean age , weight of group B were (23.13 ± 1.92) yr and (61.80 ± 4.70)kgs respectively. The participants' eligibility will be determined using the inclusion and exclusion criteria.

Adults with right hamstring inflexibility operationally defined as a knee flexion angle more than 15^0 as determined by a screening assessment employing active knee extension while lying on one's back with the hip flexed 90 degrees were required to participate in the research.

Individuals having a history of trauma to the spine, hip, or knee (including fractures, surgery, and/or ligament injuries), as well as those with any pathological disease at the spine or any lower limb joints. Disparity in leg length. People with a history of hamstring injuries were excluded from the research.

Instrumentation

Universal Goniometer

In a clinical environment, it is the device most frequently used to assess joint position and motion. It could be made of plastic or metal. The one utilized might be made of plastic or metal. The plastic half circle goniometer utilized in this investigation is one of those. A body and two narrow arms—a fixed arm and a moving arm—make up the design. There are measurement scales on both sides of the body. Full circle and half circle instruments have scales that ranged from 0° to 180° and 0° to 360°, respectively.

Weight Measure

An instrument used to measure Weight

Protocol

Based on inclusion and exclusion criteria the subjects are randomly selected and classified into 2 groups.

Group-A: Subject will perform Non-ballistic static stretch for 30 second, this is repeated 5 times followed by static stretch for 30 second after a rest interval of 5 min.

Group-B: Subject will perform static stretch maintained for 30 seconds with rest interval of 1 second between each stretch.

Procedure

Active Knee Extension Test[13]

To make it simple to reach the bony landmark, the subject is wearing shorts. Each subject's right lower extremity lying on their left side had adhesive tape applied to it at the following landmarks: 5.0 cm distal to the greater trochanter, 5.0 cm proximal to the lateral femoral condyle, 5.0 cm distal to the fibular head, and 5.0 cm proximal to the inferior tip of the lateral malleous. To keep the hips flexed at 90 degrees during vigorous knee extension action, a wooden ruler will be employed. The Goniometre was utilized to adjust the hip at 90 degrees of flexion before each trial movement. At 0° of hip flexion, the left lower extremity will be at rest. To support the cervical spine, a towel will be wrapped up and placed below the head and neck. By interlocking the fingers of both hands at the distal thigh, participants will stabilize the right hip at 90 degrees of flexion. The subject will be told to vigorously extend their right knee to the maximum while maintaining a relaxed plantar flexion of the foot. The degree from full extension will be determined using the goniometer. Subjects who exhibit a knee flexion angle of more than 15 degrees may be deemed to have hamstring flexibility and permitted to take part in the study. For active knee extension with ankle in relaxed plantar flexion and end range knee extension position obtained in the final fraction of a second, each individual did four practice trials and three test trials. Following each trial, there will be a 60 second rest time.

For Group A: Subject performed non-ballistic stretch followed by static stretch after rest interval of 5 min everyday once daily for 2 weeks.

For Group B: Subject performed static stretch once daily for 2 weeks

Static Hamstring Stretch
Perform a static hamstring stretch while assuming a modified hurdler's position on a plinth. In an effort to keep the spine in a neutral posture, the subject flexed forward from the hips. Each participant was instructed to make an effort to preserve the neutral spine by avoiding cervical flexion and only moving from the hip. Once the stretch is felt in the posterior thigh, knee, or calf, the subject will be flexed from the hip. Once this posture is reached, the stretch should be maintained for 30 seconds.

Non-Ballistic Active Stretch
The non-ballistic active stretch will be carried out while the performer is seated on a plinth at a height that prevents foot contact with the ground. The individual will sit as slumped as possible to produce complete thorco-lumbar flexion, with the thigh supported leg flexed and popletial fossa contacting the table edge. After that, the cervical spine was fully extended. The subject's hand will be put on the back of their hand, fingers interlaced. The weight of the relaxed arms will apply overpressure to the cervical and thoracolumbar spines. Maximum dorsiflexion of the right foot will be achieved. The knee was then stretched to its maximum extent while still maintaining dorsiflexion. The operational definition of the end range of knee extension is the location at which a strong resistance or stretch is felt at the posterior thigh, knee, or calf. Subject then lowered the leg while relaxing the plantar flexion of the foot. For a total of 30 repetitions, this stretch movement sequence was rhythmically repeated.

Goniometer measurement of knee range of motion.
Knee Extension Flexion :-Normal Range of Motion – 0^{o} to 135 ^{o}
Position of Goniometer – Axis of the goniometer is at the middle position, at the lateral aspect of the tibial condyle. stationary bar running parallel to the femur's long axis on the side of the thigh. a mobile bar on the lateral side of the leg that is parallel to the tibia's longitudinal axis.
Goniometer reading will taken at the time of screening and at the end of two weeks for all subjects.

Static hamstring stretch

End position for the non ballistic active knee extension stretch in neural slump sit position.

Active knee extension test

Statistical analysis :-

Version 11 of SPSS for Windows was used for the analysis. Age, height, and weight arithmetic means and standard deviations were assessed. To compare the mean values for pre-treatment and post-treatment ROM between the groups as well as the mean values for pre-treatment and post-treatment ROM within the groups, independent sample t test and paired t test were employed, respectively. The 0.05 p value was chosen**.**

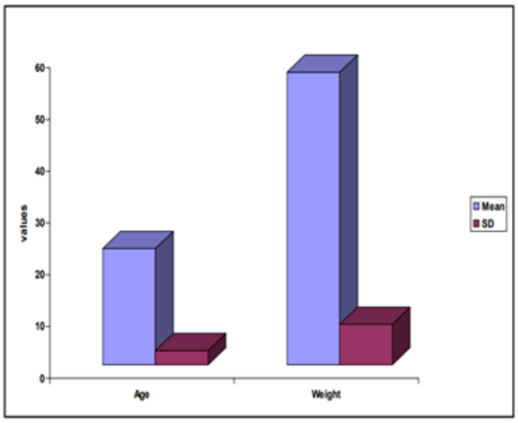
Result :-

Demographic data for 30 subjects indicate the mean age, weight(22.46±2.72; 56.66±7.81) and (23.13±1.92; 61.80±4.70) for group A and group B respectively (Table 5.1).
According to a within-group study, group A's mean range of motion was larger after treatment than it was before, and this difference was found to be statistically significant (Table 5.2).
The mean range of motion values for group B were higher than the mean values before treatment, and this difference was found to be statistically significant.

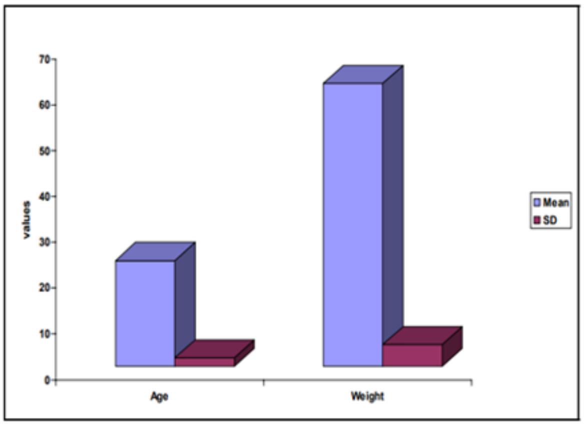
Analysis of the data between the groups showed that group A's mean post-treatment range of motion values were higher than group B's, and this difference was found to be statistically significant.

Demographic data

Variables	Mean ± SD	
	Group A	**Group B**
Age	**22.46±2.72**	**23.13 ± 1.92**
Weight	**56.66 ± 7.81**	**61.80 ± 4.70**



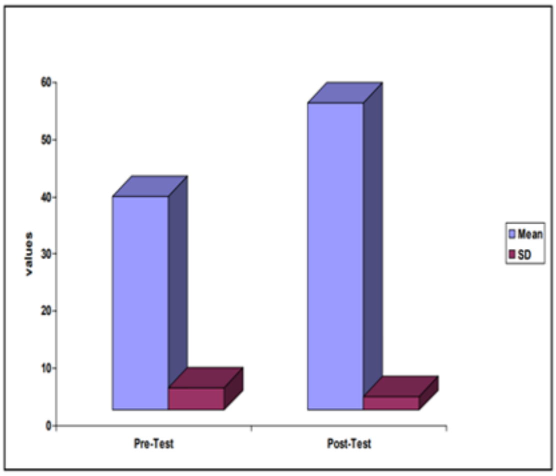
Mean and SD of Age and Weight for the Subjects of Group A



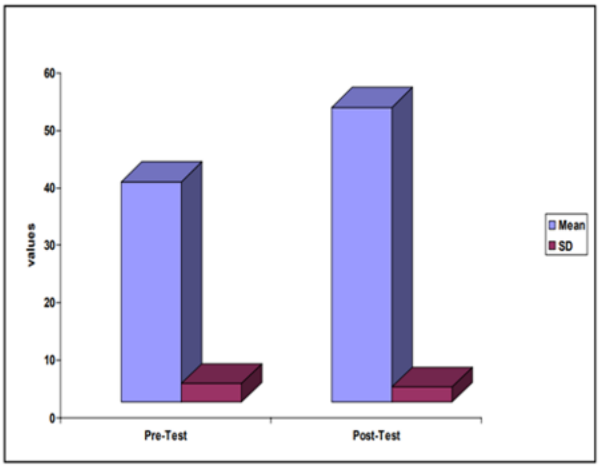
Mean and SD of Age and Weight for the Subjects of Group B

Comparison of Pre and Post Treatment ROM within Group A and Group B

GROUPS	Mean ± SD			
	Pre T/t	Post T/t	t	Sig
Group A	37.52±3.98	53.83±2.43	-28.438	0.00
Group B	38.44±3.26	51.44±2.63	-39.209	0.00



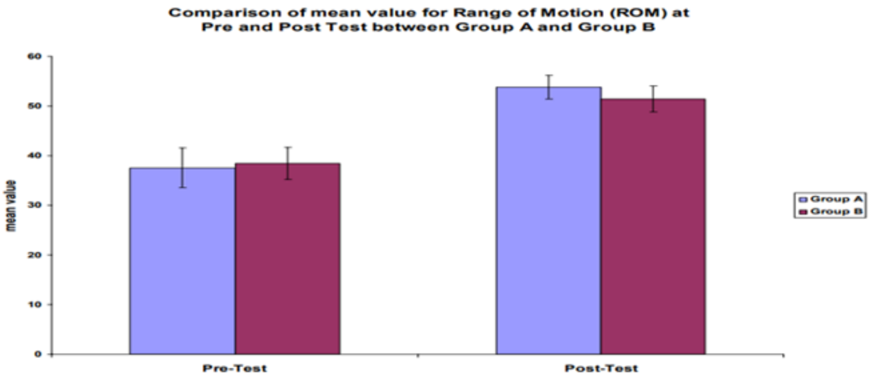
Mean and SD of Range of Motion (ROM) at Pre and Post test for the subjects of Group A



Mean and SD of Range of Motion (ROM) at Pre and Post test for the subjects of Group B

Comparison of Pre and Post Treatment ROM Between Group A and Group B

	Mean ± SD		t	Sig
	Group A	Group B		
Pre T/t	37.52 ± 3.98	38.44 ± 3.26	-0.687	0.498
Post T/t	53.83 ± 2.43	51.44 ± 2.63	-2.577	.016



Comparison of Improvement for Range of Motion (ROM) between Group A and Group B

Discussion

In this study, we discovered a substantial difference between group A (non-ballistic active knee extension plus static stretching) and group B (static stretching). These findings contrast from those of (William G. Webright et al.), who discovered no statistically significant difference between group A (non-ballistic) and group B (static stretching).

The length of the hold is the main distinction between the slump test and "slump stretching" as a treatment. In contrast to slump stretching, which requires a longer hold once the patient feels symptom reproduction, a slump test is performed until the patient feels symptom representation. There is little evidence in the literature to support slump stretching's effectiveness as a treatment for problems in the lower extremities. The use of slump stretching in Australian Rules Football players with grade I hamstring strains and positive slump tests was examined by Kanberg and Lew. They discovered that standard treatment combined with slump stretching was more successful for restoring the player to full functionality. These writers did not specify the length of stretches or the quantity of stretches**[17]**

Maitland recommended using the "slump test" to gauge the tension of the nerve endings that are sensitive to pain within the intervertebral foramina or spinal canal. He asserted that this test, which combines straight leg raise (SLR), ankle dorsiflexion, and vertebral flexion, is more sensitive than other tension tests. This was confirmed by Massey in a clinical investigation. She discovered that the slump test, compared to any of the traditional tension tests (passive neck flexion, forward flexion with neck flexion, straight leg raise (SLR), and straight leg raise (SLR) with ankle dorsiflexion), was more sensitive in reproducing the patient symptoms. The study involved 50 patients with low back pain. Therefore, the slump 48 test would be utilized to distinguish between limitations of the SLR caused by neural/dural strain and limitations caused by hamstring length**[18]**

In 57% of subjects who had an apparent repeated grade I hamstring strain, Sharon E. et al. reported a positive slump test result. This would imply that unfavorable neural stress is a key clinical characteristic of or linked to repeated hamstring strain **[19]** In a modified slump test position featuring increased hip flexion in asymptomatic volunteers, Neil Tucker et al. investigated measurement error and the reproducibility of measurements between trials on a single day and across days of knee extension AROM. According to the results, there were no appreciable variations for either the full droop or the neck-extended slump over a two-day period**[20]**. In a subgroup of patients with low back pain, Joshua A. Cleland et al. discovered that slump stretching was superior to treatment without slump stretching for improving short-term disability, reducing pain, and centralizing symptoms. It is possible that slump stretching led to a reduction in scar tissue that had adhered to neural tissue and its connective tissue structure**[13]** Steven Z. George discovered that slump stretching produced positive results in patients with lower extremity symptoms, although firm conclusions cannot be derived from this study's methodology**[21]** In our study of healthy volunteers, we discovered a significant difference between groups A and B. This difference may have been caused by the active stretch group volunteers' dorsiflexion of their ankle, medial hip rotation, and maintenance of a full spinal slump posture, including cervical flexion, before beginning non-ballistic knee extension. This was done with the idea that if the range of motion for active knee extension is restricted in a whole spine neural slump posture, the stress this positioning causes on the neural tissue may also restrict the range of motion for knee extension alone and hamstring contractile tissue**[14].** As a result of their subjects not stretching the hamstring past its resting length, William G. et al. in a related study observed no statistically significant change in the knee joint range of motion in a comparative investigation of uninjured adults in active and static stretch groups**[14]** The specific method by which greater strain in the brain tissue may have decreased knee extensibility was not examined, hence the authors do urge care in interpreting these data. There is a chance that the knee extension range of motion in this investigation was restricted at least in part by other regional structures. It has been suggested that restrictions in leg elevations during the straight leg raise test may be caused by the long head of the biceps femoris muscle, its investing fascia, and skin tissue. The knee flexors gastronemius, semitendinous, semimembranous, and the long head of biceps femoris may have contributed to the reported restriction in knee extension range of motion throughout this investigation. Stretching of the gastronemius muscle via the achilles tendon insertion to the calcaneus may have inhibited knee extensibility if the muscle reached a completely extended condition when the ankle was dorsiflexed. With the hip tilted medially during knee extension, tension may have been created in the long head of the biceps femoris muscle. Additionally, it has been observed that the deep fascia that envelops the posterior aspect of the entire lower limb's skin, subcutaneous connective tissue, and skin may all have a role in the limitation of knee extension**[22]** .In our study, slump stretching with foot dorsiflexion and medial hip rotation may have stretched these structures, leading to an increase in range of motion. Further intermuscular adhesions that may limit neural mobility would have been broken by stretching of the structures, which may have contributed to an even greater increase in range of motion. We hypothesized that this increased stretching of neural structures may have contributed to an increase in range of motion at the knee joint in our study participants. Evan K. Johnson found that each sensitizing movement (cervical spine flexion, ankle dorsiflexion, and medial hip rotation) limits the subjects' active knee extension ROM during slump testing.

Future Research

1. Study can be done using large sample size in different population such as older adults.
2. Different stretching techniques can be used in future.
3. Future applications of this study can be directed toward coaches, athletic trainers strength and conditioning professional as they prepare athletes for optimal performance.
4. Inclinometre can be used for measuring range of motion for greater reliability.
5. Study can be done using supine active knee extension test and sitting neural slump test, may help to implicate tissue to different stretching technique

Clinic Practice Relevance

According to the findings of our study, hamstring flexibility is improved more dramatically by static stretching combined with non-ballistic stretching than by static stretching alone. Therefore, to maximize results, static stretching and non-ballistic stretching should be used in any program intended to increase range of motion.

Conclusion

The current study found that hamstring flexibility in adults can be improved with static stretching and non-ballistic stretching more effectively than static stretching alone, which may be seen in improvements in the accuracy of active knee extension assessment**.**

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