# A Comparative Study on Effect of Non-Ballistic Active Knee Extension in Neural Slump Position Versus Post Isometric Relaxation Techniques on Hamstring Flexibility in Sedentary Workers

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**Abstract**

**Introduction:** Flexibility is the ability to move single joint or series of joints smoothly and easily through an unrestricted, pain free ROM. Adequate flexibility is an important characteristic of physical and health related fitness.

**Objective:** To find out the effect of Non-Ballistic Active Knee Extension in Neural Slump Position versus Post Isometric Relaxation techniques on hamstring flexibility in sedentary workers assessed using Active Knee Extension (AKE) test and Sit and Reach Flexibility test at the end of 3 weeks of intervention.

**Methodology:** The present experimental study was carried out in sedentary workers having hamstring tightness (age group of 30 to 50) at musculoskeletal physiotherapy department at PES Moderna College of Physiotherapy, Pune.

**Results:** Majority of the patients in group A were from 36-40 years age group i.e. 14(31.1%). Majority of the patients in group B were from 30-35 years age group i.e. 18(40%). Hamstring flexibility of right leg and left leg are comparable at the end of 3 weeks. Post intervention hamstring flexibility using Sit and Reach in both legs are comparable at the end of 3 weeks.

**Conclusion:** Both non-ballistic active knee extension in neural slump position versus post isometric relaxation technique's along with conventional treatment are equally effective in improving hamstring flexibility in sedentary workers.

**Keywords:** Non-Ballistic active knee extension, post isometric relaxation techniques, hamstring flexibility, sedentary workers.

## Introduction

Flexibility is the ability to move single joint or series of joints smoothly and easily through an unrestricted, pain free ROM. Muscle length in

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conjunction with joint integrity and extensibility of periarticular soft tissues determine flexibility. [1] For normal biomechanical functioning, flexibility is considered as the most essential element.[2] Muscle flexibility will allow muscle tissue to accommodate to imposed stress easily and allow efficient and effective movement.[3]

In normal healthy individuals, muscular tightness is the most common disorder because of postural malalignment, muscle imbalances, impaired muscle performance and sedentary lifestyle.[4] Hamstrings are long and powerful group of muscles that span the back of the thigh. Most people have short hamstrings as a result of spending a long time seated every day. [5]Adequate flexibility is an important characteristic of physical and health related fitness. Lack of flexibility is associated with problems in executing and sustaining various activities in daily life.[5] Importance of flexibility as a component of health-related fitness is related to prevention of orthopaedic impairments later in life, especially lower back pain. Flexible muscles permit proper pelvic rotation, decrease disc compression, and avoid excessive stretch of musculatures.[5]

The sedentary work nature has been the root cause for a variety of musculoskeletal disorders and discomforts which are broadly classified under the umbrella of Work-Related Musculoskeletal disorders (WRMSD). WRMSDs are disorders of the muscles, skeleton and related tissues which have been caused by a work place activity (particularly a repetitive activity). The common musculoskeletal symptoms reported are pain (55%) stiffness (14.8%) and the common sites affected are neck (44%), low back (30.5%), wrist/hand (19%) and shoulder (12.5%).[5]

Pradip B et al stated that 96.7% of people having tight hamstring in prolonged desk job doing IT professionals at South Bangalore. As desk job workers develop tightness of hamstring which make them prone to low back pain or other symptoms associated with back or hip, prolonged hours of sitting, work without breaks.[6]

By increasing the length of the hamstring muscles, the aim is to minimize further load/stress on the lumbar spine and increase the contribution of the hip to lumbo-pelvic motion.[7] Conventionally, stretching exercises targeting the hamstring muscle extensibility are employed to treat hamstring tightness 9/6mainly the static stretch.[8]

Slump stretch is neurodynamic test which is used to evaluate the dynamics of the neural structures of the central and peripheral nervous system from head, along the spinal cord, and sciatic nerve tract and its extension in the foot.[9]

So, the present study was carried out to find out effect of Non-Ballistic Active Knee Extension in Neural Slump Position versus Post Isometric Relaxation techniques on hamstring flexibility in sedentary workers assessed using Active Knee Extension (AKE) test and Sit and Reach Flexibility test.

## Objective

To find out the effect of Non-Ballistic Active Knee Extension in Neural Slump Position versus Post Isometric Relaxation techniques on hamstring flexibility in sedentary workers assessed using Active Knee Extension (AKE) test and Sit and Reach Flexibility test at the end of 3 weeks of intervention.

## Materials and Methods

**Sample Population:** Sedentary workers having hamstring tightness (age group of 30 to 50) were included.

**Study setting:** PES Moderna College of Physiotherapy, Pune

**Sample size:** Total 90 cases. 45 patients in each group. Group A (Conventional + Non ballistic active knee extension in neural slump position) and Group B (Conventional + Post isometric relaxation technique in neural slump position)

**Sampling Technique:** Simple Random Sampling method

**Inclusion criteria**

- Both Males and Females
- Healthy individuals in the age group of 30- 50 years with bilateral hamstring tightness
- Individuals having hamstring tightness i.e., knee flexion angle >15°
- Working with a desk job for a minimum of 5-8 hours.[6]

- Worked in a sitting job for at least 7 consecutive years.[6]

**Exclusion criteria**

- History of any recent musculoskeletal injuries like fractures, dislocation, or any soft tissue injuries in past 6 months. [6]
- Presence of tumour that can restrict ROM at hip and knee joint. [2]
- Any congenital deformity of lower limb. [6]
- History of trauma (acute or chronic) of lumbar spine, pelvis, hip and knee. [2]

**Method of data collection**

The ethical clearance was obtained from the Institutional Ethical committee. The participants who satisfy the study criteria were enrolled and briefed about the study. An informed consent was taken from each participant in the study in the language best understood to them. The participants were divided using odds and evens method into two groups i.e. Group A and Group B where Group A received Non-Ballistic Active knee extension in neural slump position along with Conventional treatment while Group B were treated with Post isometric relaxation technique along with Conventional treatment. · Pre-intervention scores for hamstring tightness were measured in the first session. Active Knee Extension (AKE) Test, Sit and Reach Flexibility Test were taken. Both the groups were assessed and treated thrice a week for 3 weeks. Post intervention scores for Active Knee Extension (AKE) Test, Sit and Reach Flexibility test were measured at the end of 3 weeks.

Group A- non-ballistic active knee extension in neural slump position

Participants were in sitting position on the table at a height which didn't allow the foot contact with the floor with thighs supported, leg flexed and popliteal fossa touching the table edge, maintaining the cervical and thoracolumbar flexion by interlocking both hands behind the neck. Participants were then be instructed to perform 30 repetitions maintaining the full dorsiflexion, up to the point where resistance or stretch felt and will held this position for the self-count of one, two, three, four by the patient. This technique was done thrice weekly for a period of 3 weeks.

Group B: post isometric relaxation technique.

Participants were in supine lying with contralateral hip and knee in semi flexed position. The leg to be treated were fully flexed at hip and knee, and then extended until the restriction barrier were identified. The calf of the treated leg were placed on the shoulder of the therapist for e.g. right leg on right shoulder. The participant were then be instructed to gently bend the knee against the resistance (here the counterforce were given by the therapist's shoulder) starting slowly and using only sub maximal strength. Inhale, and slowly built up an isometric contraction; hold the breath during the 7-10 sec of contraction. Release the breath as slowly cease the contraction. This position was held for 10-15 sec. During the second exhalation legs were straightened at the knee towards its new barrier. Procedure was repeated two more times and thrice weekly for a period of 3 weeks.

Conventional protocol:

Conventional treatment was given to both the groups. Participants perform static stretch in modified Hurdler's position by flexing forward from the hips and maintaining the spine in the neutral position. Stretch was maintained for 30 seconds until the stretch sensation was felt in the posterior thigh, knee or calf. Three repetitions of static stretch were given with the interval of 5 second in between each stretching session.

**Statistical analysis plan:**

Data were collected by using a structure proforma. Data entered in MS excel sheet and analysed by using SPSS 22.0 IBM USA. Qualitative data were expressed in terms of proportions. Quantitative data were expressed in terms of Mean and Standard deviation. Descriptive statistics of each variable were presented in terms of Mean, standard deviation, standard error of mean. Comparison of mean and SD between two groups were assessed by using paired t test. A p value of $<0.05$ were considered as statistically significant whereas a p value $<0.001$ were considered as highly significant.

## Results

**Table 1: Distribution according to age group**

| | | Group A | | Group B | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Frequency | Percent |
| Age group | 30-35 | 13 | 28.9 | 18 | 40 |
| | 36-40 | 14 | 31.1 | 8 | 17.8 |
| | 41-45 | 8 | 17.8 | 8 | 17.8 |
| | 46-50 | 10 | 22.2 | 11 | 24.4 |
| | Total | 45 | 100 | 45 | 100 |

We included total 45 patients in each group. Majority of the patients in group A were from 36-40 years age group i.e. 14(31.1%) followed by 13 (28.9%) from 30-35 years, 10(22.2%) from 46-50 years and 8(17.8%) were from 41-45 years age group. Majority of the patients in group B were from 30-35 years age group i.e. 18(40%) followed by 11(24.4%) from 46-50 years age group and 8 each i.e. 17.8% were from 36-40 years and 41-50 years age group respectively.

**Table 2: Comparison of mean age between Group A and Group B**

| Group | | N | Mean | Std. Deviation | t | p | Inference |
|---|---|---|---|---|---|---|---|
| Age | Group A | 45 | 39.49 | 6.31 | 0.049 | 0.961 | Not significant |
| | Group B | 45 | 39.42 | 6.57 | | (>0.05) | |

Mean age of the patients in Group A was 39.49±6.31 years and in Group B was 39.42±6.57 years. When we compared the mean age between two groups, the difference was not significant. It means both the groups were comparable with respect to age group.

**Table 3: Comparison of mean hamstring flexibility of right leg using AKE test between Group A and Group B**

| Group | | N | Mean | Std. Deviation | t | p | Inference |
|---|---|---|---|---|---|---|---|
| Hamstring flexibility Right Leg post intervention | Group A | 45 | 18.80 | 3.83 | -0.043 | 0.933 | Not significant |
| | Group B | 45 | 18.84 | 5.72 | | (>0.05) | |

We assessed the hamstring flexibility of right leg. Mean hamstring flexibility in Group A was 18.80±3.83 and in Group B was 18.84±5.72. When we compared the mean difference in the hamstring flexibility between two groups, the difference was found to be statistically not significant. It means both the groups are comparable at the end of 3 weeks.

**Table 4: Comparison of mean hamstring flexibility of left leg using AKE test between Group A and Group B**

| Group | | N | Mean | Std. Deviation | t | p | Inference |
|---|---|---|---|---|---|---|---|
| Hamstring flexibility Left Leg post intervention | Group A | 45 | 20.22 | 5.07 | -0.097 | 0.92 | Not significant |
| | Group B | 45 | 20.33 | 5.73 | | (>0.05) | |

We assessed the hamstring flexibility of left leg. Mean hamstring flexibility in Group A was 20.22±5.07 and in Group B was 20.33±5.73. When we compared the mean difference in the hamstring flexibility

between two groups, the difference was found to be statistically not significant. It means both the groups are comparable at the end of 3 weeks.

**Table 5: Comparison of post intervention HAMSTRING FLEXIBILITY (Sit and Reach Test) in Group A and Group B**

| Group | | N | Mean | Std. Deviation | t | p | Inference |
|---|---|---|---|---|---|---|---|
| Hamstring flexibility post intervention | Group A | 45 | 30.91 | 1.31 | -3.679 | 0.06 | Not significant |
| | Group B | 45 | 34.53 | 1.20 | | (>0.05) | |

Mean post intervention hamstring flexibility using Sit and Reach in Group A was 30.91±1.31 and in Group B was 34.53±1.20. When we compared the mean difference in the hamstring flexibility between two groups, the difference was found to be statistically not significant. It means both the groups are comparable at the end of 3 weeks.

**Table 6: Comparison of difference of HAMSTRING FLEXIBILITY (Sit and Reach Test) in Group A and Group B**

| Group | | N | Mean | Std. Deviation | t | p | Inference |
|---|---|---|---|---|---|---|---|
| Hamstring flexibility pre and post difference | Group A | 45 | 6.04 | 1.93 | -5.487 | 0.098 | Not significant |
| | Group B | 45 | 7.27 | 1.91 | | (>0.05) | |

MeanSit and Reach (pre and post difference) in Group A was 6.04±1.93 and in Group B was 8.27±1.91. When we compared the mean difference between two groups, the difference was found to be statistically significant. It means Sit and Reach (pre and post difference)was more in Group B as compared to Group A in our study.There was significant difference with p value 0.001 when compared non-ballistic active knee extension test and post-isometric relaxation technique for Left Leg hamstring flexibility in sedentary workers (age 30 to 50 years) at the end of 3 weeks.

## Discussion

The present study was undertaken with the intention to see the effect of Non-Ballistic Active Knee Extension in Neural Slump Position as compared to Post Isometric Relaxation Technique on Hamstring Flexibility by measuring popliteal angle taken by using AKE test and Sit and Reach test in Sedentary Workers in the age group between 30 to 50 years.

In this study total of 90 sedentary workers were included with 45 in each group. Group A received Non-Ballistic Active Knee Extension in Neural Slump Position with Conventional treatment while Group B received Post-Isometric Relaxation technique with Conventional treatment for 3 weeks.

The probable reason of reduced knee flexion angle post neural stretch can be attributed to the improved physiological functions of nervous system, including improved axoplasmic flow and vascular perfusion and reduced neuromeningeal mechano-sensitivity. According to Shaclok, Damaged or inflamed nerves leads to increase in mechano-sensitivity which is a direct response to mechanical loading of the neural structures.[10]

My study is supported by Roberto Mendez-Sanchez et. al. in 2010 in which they have attributed improved lower quadrant mobility post neurodynamic intervention to the decrease in neural mechano-sensitivity, and states that the subgroup of patients with hamstring strain that have neural tissue involvement, benefit from adding neural mobilization techniques to the rehabilitation program. [11]

Study done by Cornelius, W.L Rauschuber, M.R found that an isometric contraction greater than 6 seconds up to 10 seconds was sufficient to produce desired outcome. This is followed by the 2 nd phase, where the muscle was held in relaxed position for

7 to 10 seconds and then knee was passively stretched to new barrier and held for 30 seconds. After a phase of isometric contraction, the muscle would show an increased flexibility due to decreased resting tension which was due to the post contraction inhibition of alpha motor neuron and/or by reduced motor neuron excitability.In Post-isometric relaxation technique, a strong muscle contraction against equal counterforce triggers the Golgi tendon organ. The afferent nerve impulse from the GTO enters the dorsal root of spinal cord and meets with an inhibitory motor neuron and therefore prevents furthercontraction, the muscle tone decreases which in turn results in agonist relaxing and lengthening.[12]

## Conclusion

The present study concluded that both non-ballistic active knee extension in neural slump position versus post isometric relaxation technique's along with conventional treatment are equally effective in improving hamstring flexibility in sedentary workers.

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**Conflict of Interest:** Nil

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