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# THE EFFECTIVENESS OF NEURODYNAMIC SLIDING TECHNIQUE AND STATIC STRETCHNG ON HAMSTRING FLEXBILTY OF THE OFFICE WORKERS- A COMPARATIVE STUDY

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## ABSTRACT

***Introduction:*** Flexibility is defined as the range of motion available in a joint or a group of joints that is influenced by muscles, tendons, ligaments and bones. Decreased hamstring flexibility is suggested to be one of the predisposing factors for hamstring strains. ***Objective:*** To compare the effect of neurodynamic sliding technique and static hamstring stretching to improve flexibility and range of motion in office workers. Method: In the present study, the 40 office workers between age group 25-55 years were selected from the outpatient department in clinical setting. They weredivided into 2 groups of 20 patients (group A and group B). Group A was given neurodynamic sliding technique and Group B was given static hamstring stretch. Both group were given superficial heatintheformofhydrocollatorpackbe for eeachsession of stretching. The outcome measures were Sit and Reach test and Active knee extension test. ***Result:*** The values were statistically analysed using paired and independent `t' test. The results of the test showed that there is significant improvement in hamstring flexibility and range of motion of group A subjects. ***Conclusion:*** Neurodynamic sliding technique canbetter reduce hamstring tightness and there by better improvement in flexibility and ROM in office workers.



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# INTRODUCTION

Flexibility is defined as "The range of motion available in a joint or a group of joints that is influenced by muscles, tendons, ligaments, and bones (De Coster, 2004). Claims have been made that increased flexibility resulting from stretching activities may decrease the incidence of musculotendinous injuries, minimize and alleviate muscle soreness, and improve performance (Anderson, 1991; De Vries, 1978; Liemohn, 1978; Worrell, 1991; Athletic Training and Sports Medicine, 1991 and Agre, 1985). Restricted flexibility can be related to number of variables, including joint capsule or other soft tissue restriction (Chang, 2001 and Wiemann, 1997). Stretching is the therapeutic maneuver designed to increase mobility of soft tissue and subsequently improve ROM by elongating structures that have adaptively shortened and have become hypo mobile over time (Wilkinson, 1992). Once flexibility is assessed and flexibility insufficiency is identified, a stretching program can be customized, emphasizing those areas in need of improvement (Gleim, 1992). Traditionally the most widely used method to increase range of motion is stretching. Static stretching is slow speed, passive movement to place a muscle on stretch (Chang, 2001). Tissue elongation varies according to the type and duration of the force applied. However the research proved a low load, long duration stretch in place of a high load, brief stretch is required to produce greater tissue lengthening and remains even after the tensile stress is removed (Bandy, 1997). Effective hamstring stretches and hamstring injury treatment is vital to the overall health and condition of the hamstring muscles. The prevention of hamstring injury comes down to the conditioning of the hamstring muscles and tendons, which ultimately involve stretching and strengthening. Increasing flexibility, with regular hamstring stretches, will contribute greatly to the ability of the hamstring muscle to resist strains and injury (Brad Walker, 2008). Biomechanically the synchronization between two joints is a complicated proprioceptive and mechanical problem. This is complicated further when muscle units cross both joints. Muscles which have not been trained to employ their full amplitude may fall when required to pass through their full amplitude under rapid and stressful situation. This results in varying degree of muscle damage and specific stretching programs are needed on daily basis to prevent further injury (Morgan, 2000). Hamstring muscle consists of semitendinosus, semimembranosus and biceps femoris.The action of the hamstring is to flex the knee and extend the hip. Decreased hamstring flexibility is suggested to be one of the predisposing factors for hamstring strains (Jonhagen, 1994; Cross, 1999; Liemohn, 1978; Witvrouw, 2003). Tight hamstrings can contribute towards injuries such as low back pain, popliteal injury and may limiting to sports perfomance. The main causes of hamstring tightness could be genetic, engaging in sports activities without proper prior stretching, sedentary lifestyle and in people who have to sit for longer duration at their chair as their profession demands. Long periods of sedentary work can increase the chance of developing hamstring tightness and in turn backpain (Anderson, 1991). Long duration of sedentary work can cause muscle and joint pain, backpain, muscle tightness etc. such muscle and joint problems can be caused or made worse by poor chair design, sitting in bad posture for a long time. Although sitting requires less muscular effort compared to standing, it still causes physical fatigue (tiredness) and you need to hold parts of your body steady for long period of time. This reduces circulation of blood to your muscles, bones, tendons, and ligaments, sometimes leading to stiffness and pain. If workstation is not set up properly, these steady positions can put even greater stress on your muscles and joints (Anderson, 1991; Iashvilli, 1987; Buroker, 1989). Static stretching considered to be the gold standard for improving flexibility; is elongating a muscle slowly to tolerance (comfortable stretch, short of pain) and sustaining the position for a length of time. This technique requires less energy and it alleviates muscle soreness (Buroker, 1989), improves muscle perfomance, promotion of healing, thus improved flexibility (Smith, 1994; Borms, 1987 and Halbertsma, 1996). The mechanosensitivity of neural structures in the posterior leg, thigh, buttock and vertebral canal may have a role in determining hamstring flexibility. Decreased hamstring flexibility as evidenced by limited range in the passive straight leg raise test (SLR) could bedue to altered neurodynamics affecting the sciatic, tibial, and common fibular nerves. Protective muscle contraction of the hamstring muscles found in the presence of neural mechanosensitivity (Hall, 1998 and Boyd, 2009) may account for hamstring tightness and thereby predispose the muscle to subsequent strain injury.Neurodynamic sliding interventions are thought to decreased neural mechanosensitivity and it is possible that the inclusion of these interventions in the management of hamstring flexibility could be beneficial (Hall, 1998; IDe-la-Llave-Rincon, 2012).

Hamstring extensibility is a physical fitness component widely recognized as an important marker of health and quality of life (Garber et al., 2011). Hamstring injuries continue to affect active individuals and although inadequate muscle extensibility remains a commonly accepted factor, little is known about the most effective method to improve flexibility .This study is essential as many of the sedentary populations are having short hamstrings and are more susceptible for injury. although many studies are conducted regarding hamstring flexibility, the effect of neurodynamic sliding technique and static stretching is inadequately studied and still requires attention. Hence this study was planned (Brown, 2011). Purpose of this study is to investigate the effect of neurodynamic sliding technique in hamstring flexibility of office workers and to investigate the effect of static stretch in hamstring flexibility of office workers and also to compare the effect of neurodynamic sliding technique and static stretching programme in hamstring flexibility of office workers.

# METHODS

The research used a pre-post-test experimental group design. 20 subjects with tight hamstring muscle (inability to a chieve greater than 160 degree of knee extension with hip at 90 degree of flexion) aged between 25-55 years who fulfilled the inclusion criteria were recruited randomly into two groups of 10 each by convenience sampling. Consent was obtained from them prior to the study. Assessment was taken for all 20 subjects using Active knee extension, sit and reach test on the first and the last day of treatment. The subjects were divided into two groups, Group A subjects (experimental) were given neurodynamic sliding technique and group B (experimental) were treated with static stretching programme. Inclusion criteria's comprised of only males, Age in between 25-55yrs, Tight hamstring muscle (inability to achieve greater than 160 degree of knee extension with hip at 90 degree of flexion), and Sit and reach value (9- 28 cm). Subjects with low back pain, Individuals with any degenerative diseases in hip, knee, ankle, like osteoporosis, Metal pins, plates or screws in the femur or tibia, any deformity such as genu valgum, varum, Subjects exceeding 80 degrees in SLR. Subjects with history of neck trauma and Subjects history of fracture in any part of the body were excluded from the study. The outcome was based on measurement of active knee extension test and sit and reach test, both are reliable and valid tool for the purpose. Pre-test value of active knee extension test and sit and reach test were assessed before the intervention and the post-test values of the same was collected after 8 weeks intervention.

## Procedure

**Group A Experimental group 1:** Neurodynamic sliding technique.

Subject is in supine position with cervical and thoracic spine maintained in flexion.neurodynamic sciatic slider technique is performed by alternating hip flexion, knee flexion and ankle dorsiflexion with hip extension,knee extension and ankle plantar flexion. movements were performed for total 180 seconds.i.e30 seconds technique repeated 6 times (Cross, 1999).

**Group B Experimental Group 2:** Static stretching programme.

Subjects were instructed to take the table with their hips, leg straights ahead and flex forward at the waist until a hamstring stretch was perceived.subjects were cautioned against and monitored to prevent posterior tilting of pelvis or rounding the trunk forward or both performing the assigned stretch to each day 6 times for 15 seconds. Each subjects rested for 15 seconds between stretch and during the rest period removed their leg from the table (Sharma, 2004).

**Superficial Heat:** Superficial heat in the form of Hydrocollator pack was applied before each session of stretching for both groups.packs contain silicate gel in a cotton bag.these packs were placed in a hot water tank ,which was thermostatically controlled at 71.1-79.4 degree celsius.hot packs were applied over 2-3 layers of towel for 20 minutes (Akinpelu, 2009).

**Popliteal Angle/ Active Knee Extension Test:** Pre-post and follow up measurement data on Popliteal angle were collected from both groups. Subjects were assessed for hamstring tightness using the Active Knee Extension test (Popliteal angle). The subject was in supine position with hips flexed 90° and knee flexed. A cross bar was used to maintain the proper position of hip and thigh. The testing was done on the right lower extremity and subsequently the left lower extremity and the pelvis were strapped down to the table for stabilization and control on accessory movements. Landmarks used to measure hip and knee range of motion were greater trochanter, lateral condyle of femur and the lateral malleolus which were marked by a skin permanent marker. The fulcrum of the goniometer was centered over the lateral condyle of the femur with the proximal arm secured along the femur using greater trochanter as a reference. The distal arm was aligned with the lower leg using the lateral malleolus as a reference. The hip and knee of the extremity being tested were placed into 90° flexion with the anterior aspect of thigh in contact with the horizontal cross bar frame at all times to maintain hip in 90° flexion. The subject was then asked to extend the right lower extremity as far as possible until a mild stretch sensation was felt. A full circle goniometer was then used to measure the angle of knee flexion. Three repetitions were performed and an average of the three was taken as the final reading for Popliteal Angle (Marques, 2009).

**Sit and reach test:** There are various techniques and variations of the Sit and Reach test. The one which is explained below is based upon the Young Men's Christian Association (YCMA) from the American College of Sports Medicine (ACSM) guideline, 2014.

- **Pretest:** Clients/Patients should perform a short warm-up prior to this test with some gentle stretches. During the test, participants are suggested not to do fast, jerky movements, which may increase the possibility of an injury. The participant's shoes should be removed.
- A yardstick is placed on the floor and tape is placed across it at a right angle to the 15 inches mark. The client/patient sits with the yardstick between the legs, with the legs extended at right angles to the taped line on the floor. Heels of the feet should touch the edge of the taped line and be about 10 to 12 inches apart.
- The client/patient should slowly reach forward with extended arms, placing one hand on top of the other facing palms down, as far as possible, holding this position for approximately 2 seconds. Be sure that the participant keeps the hands parallel and does not lead with one hand. Fingertips can be overlapped and should be in contact with the measuring portion or yardstick of the sit-and-reach box.
- The score is the most distant point (cm or in) reached with the fingertips. The best of three trials should be recorded. To assist with the best attempt, the client/patient shoul d exhale and drop the head between the arms when reaching. Testers should ensure that the knees of the participant stay extended; however, the participant's knees should not be pressed down. The client/patient should breathe normally during the test and should not hold her/his breath at any time.
- Note the zero point at the foot/box interface to use the appropriate norms. So, for YCMA the "zero" point is set at the 15 inches mark.[36]

# RESULTS

Table 1 Data are mean ± standard deviation (sd). In the Group A, the mean age is 18.93 and sd is 0.92 and in the Group B, the mean age is 19.21 and sd is 0.80 which was not statistically significant (þ-value >0.388). In the Group A, the mean BMI is 22.24 and sd is 0.74 and in the Group B, the mean BMI is 22.68 and sd is 0.62 which was not statistically significant (þ-value >0.103). In summary data was homogenous among both groups.

**Evaluation of active knee extension test in Group A:** By comparing the mean value of pre test and post test values of AKE, mean post test value of AKE is 10.4500 which is less than 15.0000, which indicates that there is significant increase in AKE. By analyzing the pre test and post test values of AKE by pared t-test, the calculated value t=13.534 which is greater than the table value t=2.093(df=19 at p=0.05).which indicates that there is significant difference between the pre test and post test values of AKE in group A.

***Evaluation of sit and reach test in Group A:*** By comparing the mean value of pre test and post test values of SAR, mean post test value is 21.3000 which is greater than pre test value 14.9000, which indicates that there is significant difference between the pre and post test values of SAR. Also by using Wilcoxon Signed Rank Test, The p value of 0.000 which being smaller than 0.05, it indicates that there is significant difference between pre and post test values of SAR in group A.

***Evaluation of active knee extension test in Group B:*** By comparing the mean value of pre test and post test values of AKE, mean post test values of AKE is 12.1000 which is less than pre test value 14.8000, which indicates that there is significant increase in AKE.Also by analyzing the pre test and post test values by paired t-test, the calculated value t=16.480 (sig0.000) whch is greater than the table value t=2.093(df=19 at p=0.05), which indicates that there is significant difference between the pretest and post test values of AKE in Group B.

***Evaluation of sit and reach test in Group B:*** By comparing the mean value of pre test and post test values of SAR, mean post test value is 21.5500 which is greater than pre test value 18.5500, which indicates that there is significant difference between pre and post test values of SAR. Also by analyzing the pre test and post test values by paired t test, the calculated value t=16.882(sig0.000) which is greater than the table value t=2.093(df=19 at p=0.05), which indicates that there is significant difference between the pre test and post test values of SAR in Group B.

***Comparison between group A and group B:*** From the independent sample t-test, it is evident that significant value 0.024 which is less than probability value p=0.05 and calculated t-value=2.355 which is greater than table value t=2.024(df =38); which indicates that there is statistical significant difference between the average pre post test values of knee extension in the group A and group B ,also from group statistics shown above we can see that test values of group A shows greater improvement than that in group B .Also while comparing the percentage difference of AKE and SAR between Group A and B, Group A has more percentage difference in both outcome measures. Hence, we reject null hypothesis and accept the alternate hypothesis that "There is significant difference between the effect of neurodynamic stretch and static stretching on hamstring flexibility of the office workers."

# DISCUSSION

The study was conducted to compare the effectiveness of neurodynamic sliding technique and static stretching on hamstring flexibility in office workers. In this study, subjects with hamstring tightness were taken into consideration. For this study 40 Office workers were included and they were divided into 2 groups named group A and group B having 20 members each. Group A were given neurodynamic sliding technique of hamstring and group B was given static stretching of hamstring muscle. Outcome measures used were active knee extension test and sit and reach test. All the included subjects received the allocated treatment for the complete study duration with no drop out. Then datas were analysed statistically. Statistical data reveals that neurodynamic sliding technique and static stretching of hamstring had significance difference in improving hamstring flexibility in office workers. According to Carolyn kisner [53], static stretching is a commonly used method of stretching in which soft tissues are elongated just past the point of tissue resistance and then held in the lengthened position with a sustained stretch force over a period of time. stretching exercises can benefit athletes and social exercisers in numerous ways, including improving flexibility, reducing the incidence of injury, and enhancing athletic perfomance. Causes of tight hamstrings could be genetic, engaging in sporting activities and in people who have to sit for longer duration at their chair as their profession demands (Feland, 2001; Flanagan, 2012; Chan, 2001).

Many Factors contribute to the clinical success of a stretching program. The frequency, intensity, and duration are critical to achieve plastic deformation of the tissue and lasting gains in ROM. As stated earlier, the nervous system regulation of tension and length is performed by the Golgi tendon organ and muscle spindle respectively. When a muscle is repeatedly stretched, a muscle spindle records the change in length, thus activating the stretch reflex and causing a change of muscle length through a muscle contraction (Baltaci, 2003; Johnson, 2014; Chung, 1999). Static stretching, considered to be the gold standard for measuring flexibility, is elongating a muscle slowly to tolerance (comfortable stretch, short of pain) and sustaining the position for a length of time. The statistical analysis of SAR test paired t test show significant difference on pre test and post test scores of group A and Group B. The statistical analysis of AKE test show significant difference on pre test and post test of group A and group B.The statistical analysis of SAR test and AKE test, the Mann Whitney U test showed significant difference of post test scores of group A over group B. Hence the post test statistical analysis of group A results compared with group B show superiority of neurodynamic sliding technique on improving hamstring flexibility than static hamstring stretching and this permits the rejection of null hypothesis. Studies done on the effectiveness of application of heat prior to stretching reveals the fact that most methods of superficial heating can heat large areas but smaller volume of tissue and it can definitely increase the extensibility of soft tissue. Studies also support the fact that superficial heating given prior to stretch was better than when stretching was given alone. Thus the results and findings of the study indicates that Neurodynamic sliding technique is effective in improving hamstring flexibility and the effect is gained in 6 weeks of treatment. Hence Neurodynamic sliding technique is effective than static stretching on improving hamstring flexibility. The gained flexibility can be maintained by continuing the stretching program (Hui, 2000 and Guariglia, 2011). There were few limitation identified for the current research study are Sample size taken for the study was small, All measurement was taken by the researcher himself hence bias can be expected, All the measures were taken manually and this may introduce human error which could affect the reliability of the study, Study was conducted only in office workers, Study in the subjects with long legs and /or short arms have a disadvantage, as the values may slightly vary. Subjects having lack of low back flexibility may give values that can mislead, Study did not include a long term follow up hence the result cannot tell the effectiveness of long term use of the treatments. Future recommendation are to make the results more valid a long term study may be carried out. Further study can be done using different stretch duration and stretch hold time. To establish the efficiency of the treatment a large sample size study is required. Use of a different functional outcome measure could make the study more valuable. Blinding of the procedures could improve the reliability of the outcome. A follow up study could ensure the long term effectiveness of the treatment given.

# CONCLUSION

In light of the study's results and the corroborating evidence, the experimental hypothesis was accepted, whereas the null hypothesis was rejected. The findings indicate that the application of the neurodynamic sliding technique to the hamstring muscles produced significantly greater improvements in flexibility and range of motion compared to static stretching interventions."

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