Acute Effects of Neurodynamic Sciatic Nerve Tensioning Versus Sliding on Hamstring Flexibility and Agility among Normals

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Abstract: ***Background**: The nerve tension, tightness and immobility are the main causes of hamstring flexibility and hamstring injury. In presence of neural mechanosensitivity the protective muscle contraction occurs and it leads to hamstring tightness predisposing to subsequent strain injury. Nerve mobilization, evolving techniques integrates both musculoskeletal and neural structures by a "Flossing" of the nervous system to reduce pain and increase range of motion. It has two types: Tensioners and Sliders. **Objectives**: To compare the immediate effect of neurodynamic tensioners versus neurodynamic sliders on hamstring flexibility and agility performance applied to normal male college students. **Methods**: Thirty subjects having knee flexion angle of more than 20° of AKE test were selected as subjects. Consent obtained from all thirty subjects. Pretest measurements, AKE test for hamstring flexibility and Agility T test for Agility performance were measured in the dominant leg and noted. Subjects were randomly divided into two groups. Subjects in group A received Neurodynamic Tensioners and Subjects in group B received Neurodynamic Sliders. After the intervention, post test scores of AKE and Agility T test were measured and noted. **Results & Discussion**: Statistical tool used was student 'T' test. It was found that both neurodynamic sciatic nerve tensioners and sliders are effective in improving hamstring flexibility and agility in normal and sliders had a slightly greater improvement in flexibility and agility than tensioners. **Conclusion**: These data suggests that both the tensioners and sliders may be useful in increasing hamstring flexibility and agility.*

Keywords: Neurodynamic tensioning, Neurodynamic sliding, Active knee extension angle, Agility, Hamstring flexibility

1. Introduction

Neurodynamics (ND) is the term used to describe the integration of the morphology, biomechanics, and physiology of the nervous system (Shacklock et al., 2005). ND is described as a method of neural mobilization in which force is applied to nerve structures through posture and multi joint movement (Coppieters& Butler, 2008) with the primary objective to restore the dynamic balance between the neural tissues and surrounding mechanical interfaces, thereby allowing reduced intrinsic pressures on the neural tissues and promoting optimum physiologic function (Ellis &Hing, 2008) [1]. The neurodynamic technique has been used in clinical settings for the mobilization of peripheral nerve and surrounding structures 17[2].

Reduced hamstring flexibility can result from immobilization of the sciatic, tibial, and peroneal nerves, which can then lead to an outcome of a compromised straight leg raise (SLR) test[3]. However, abnormal nerve mobilization may result in reduced muscle length while resting as well as changes in the perception of pain or stretching[4]. For example, Sharma et al, reported that a significantly greater hamstring flexibility was obtained when the neurodynamic technique was combined with muscle stretching compared to muscle stretching alone[5]. Butler et al, suggested the use of a slider or tensioner as a means of moving nervous tissues[6]. The neurodynamic technique can be effective in reducing neural mechanosensitivity and managing hamstring flexibility[7]. Neural mobilization techniques have been widely used to evaluate and improve the mechanical and neurophysiological integrity of the peripheral nerves in clinical population and can be subdivided into tensioning techniques and sliding techniques[8].

To the best of our knowledge, there has been no study which has evaluated the immediate effects on hamstring flexibility and agility performance of neurodynamic techniques applied to the lower extremities. Therefore, the aim of this study is to investigate the immediate effect of neurodynamic tensioners versus neurodynamic sliders on hamstring flexibility and agility performance applied to normal male college students

2. Literature Survey

- Bhavana S Mhatre et al (2013) conducted a study on "Which is the better method to improve perceived hamstrings tightness - Exercises targeting neural tissue mobility or exercises targeting hamstring muscle extensibility. "A prospective trial of 56 female students with perceived hamstring tightness was conducted. Subjects were randomly divided into two groups. Group A received Mulligan's bent leg raise (BLR) followed by Two Leg rotation technique (TLRT) to improve neural tissue mobility and Group B received passive hamstring stretching to improve hamstring muscle extensibility. Outcome measures included active knee flexion angle (AKE) and slump test. Intra group analysis showed statistically significant improvement in knee flexion angle for both tests in both groups. Inter group comparison showed that there was greater improvement in the group receiving neural tissue mobility with statistically significant improvement in slump test with cervical extension (mean difference was 7.214 degree). This study concluded that exercise which target neural tissue mobility are 7 more effective than exercises targeting hamstrings muscle extensibility in treating "perceived hamstrings tightness".

- YC Caballero et al (2012) processed a research on effects of neurodynamic technique on hamstring flexibility in healthy male soccer players.28 young male soccer players were randomly assigned to one of two groups: neurodynamic sliding or control. Each subject's dominant leg was measured by SLR test pre and post intervention. At the end of study, the groups were significantly different with more ROM in the group that received neurodynamic intervention. Findings suggest that a neurodynamic sliding technique can increase hamstring flexibility in healthy male soccer players.
- RJ Bonser et al. (2016) conducted a study on change in hamstring range of motion following neurodynamic sciatic sliders: A critically appraised topic. Researchers randomized 120 individuals with bilateral complaints of hamstring tightness and decreased ROM on passive SLR. Group 1 receives neurodynamic sliding, group 2 receives static stretching and group 3 receives PNF stretching. Single application of neurodynamic sliding was more effective an increasing ROM than static stretching. While others determined both neurodynamic sliding and static stretching equally increased the ROM following three sessions over one week period. Another group of researchers used three treatment session, researchers determined that both PNF and neurodynamic sliding were effective at increasing ROM.
- YC Caballero et al (2014) processed a research on immediate effects of neurodynamic sliding versus muscle stretching on hamstring flexibility in subjects with short hamstring syndrome.120 subjects with short hamstring syndrome were randomized to 1 - 3 groups: neurodynamic sliding, hamstring stretching and placebo control. Range of motion was measured by SLR before and after intervention. Finding suggested that a neurodynamic sliding technique will increase the hamstring flexibility to a greater degree than static stretching.
- S Golhar et al (2017) conducted a study on long term effect of neurodynamic sliding technique to improve hamstring flexibility in football players.30 male subjects with passive SLR less than 80° were divided into 8 two groups: Neurodynamic sliding and control group. Subject were treated with neurodynamic sliding for over a week on three different days and passive SLR was re measured at end of first week, first month and second month. He concluded that neurodynamic sliding technique has a long term effect in improving hamstring flexibility.
- Jessica Ferreira et al (2018) conducted a study to compare the effects of tensioning neural mobilization versus sliding neural mobilization of the dominant lower limb on static postural control and hop testing. Thirtyseven football players were randomized into two groups: sliding neural mobilization (n=18) or tensioning neural mobilization (n=19) targeting the tibial nerve. Static postural sway was assessed with a force plate and functional performance with hop tests. Measurements were taken at baseline, after the intervention and at 30 minutes follow up. There was a significant effect of time for the centre of pressure total displacement and velocity ($p < 0.001$) and a moderate negative relationship exists between the ESST and both the T - Test ($r = -0.69$, $p < 0.001$) and IAT ($r = -0.65$, $p < 0.001$). The results suggest that these tests are valid measures of agility that uniquely assess movement in different planes, thus providing a comprehensive assessment of high - level mobility.
- JR Skaggs et al (2015) did a study on flexibility associated with improved sprint and jump performance 37 high school track and field athletes performed flexibility and performance tests. Hamstring flexibility was evaluated using the sit and reach test and knee extension angle test. This study examining flexibility and athletic performance they found no evidence that flexibility is associated with improved sprint and vertical jump performance. Increased hamstring flexibility, measured by knee extension angle was associated with a decrease in vertical jump height.
- MSA Hamid et al (2013) did a study on interrater and intrarater reliability of the AKE test among healthy adults.14 healthy participants volunteered, two raters conducted AKE test independently with aid of a simple and inexpensive stabilizing apparatus. The finding suggests the current AKE test showed excellent interrater and intrarater reliability for assessing hamstring flexibility in healthy adults.
- A Schulze et al (2013) conducted a study on active muscle extension testing of the hamstring. The AKE test performed in 119 healthy fitness athletes evaluated biometric and anthropometric data and examined joint function knee and hip activity scores. The average knee extension deficit was measured 31.6° 8 ±12.6°. They concluded that like female gender, physical work, and sport activities for many years affect the muscle elasticity while body fat content and hip flexion are combined to female gender considered as indirect factors of hamstring flexibility.
- N Malliaropoulos et al (2015) processed a research on active knee range of motion assessment in elite track and field athletes. The AROM measured bilaterally with the AKE test during an in session period with a goniometer in 127 athletes. Male jumpers and runners had a higher mean AROM than throwers, but it was not statistically significant. Female jumpers had a higher mean AROM than both throwers and runners, but this was also not statistically significant. These finding suggest that posterior thigh muscle flexibility is associated with performance, the higher AROM, the better performance is achieved by athletes generally have high AROM, and this may be result of their increased muscle flexibility.
- T Neto et al (2014) processed a research on reliability of AKE test and SLR test in subjects with flexibility deficits.102 participants volunteered 11 for this study. All participants performed, in each lower limb, two trials with both AKE and SLR. The values of standard error measurement were low for both tests (2.6° - 2.9° for AKE, 2.2° - 2.6° for SLR). These findings suggest that both AKE and SLR have excellent intrarater reliability.

3. Methods

Total of 30 subjects were recruited using non probability convenient sampling. Subjects with hamstring tightness were screened using the AKE (Active knee extenson angle) test. Students having knee flexion angle of more than 20° of AKE test were selected as subject. Consent was obtained from all thirty subjects. Subjects were initially examined for the inclusion and exclusion criteria. All the eligible participants were verbally instructed as to the intent and protocol of the study. Procedure of the treatment was explained well and informed consent was collected. Pretest measurements were AKE test for hamstring flexibility and Agility T test for Agility performance. The AKE and T test were measured in the dominant leg and noted. AKE test procedure - The subject is positioned on the examination table in supine, the lower limb that is'nt examined is positioned in stabilised on the support surface. The opposite limb is elevated so that the hip is in 900 of flexion and the knees are extended to reach a position perpendicular to the ground. A lag of 200 is considered normal from full extension, anything less than 200 is considered as hamstrings tightness. This range was measured using a standard goniometer placed at the knee with the fulcrum at the lateral epicondyle, the stationary arm parallel to the thigh pointing to the greater trochanter and the moveable arm parallel to the leg pointing to the lateral malleoli. Agility T test technique - Subjects were asked to sprint forwards 9.14 m from the start line to the first cone and touch the tip with their right hand, shuffle 4.57 m left to the second cone and touch with their left hand, then shuffle 9.14 m to the right to the third cone and touch with their right, shuffle 4.57 m back left to the middle cone and touch with their left hand before finally back pedalling to the start line. Time began upon subjects passing through the timing gates and stopped upon them passing through on return. The test will not be counted if the subject crosses one foot in front of the other while shuffling, fails to touch the base of the cones, or fails to face forward throughout the test. The best time of three successful trials were taken.15 Subjects were randomly divided into two groups. Subjects in group A received Neurodynamic Tensioners and Subjects in group B received Neurodynamic sliders. Group A (Neurodynamictensioners) – In this group the subjects received Neurodynamic Tensioners. The procedure of this intervention was patient has to be sitting at the edge of the couch and hand held together behind back. The concurrent movement of the hip flexion, knee extension and dorsiflexion followed by cervical and thoracic forward flexion altered dynamically by concurrent movement of plantar flexion, knee flexion, and hip extension followed by cervical and thoracic extension/neutral. This movement was done for 10 repetitions in dominant leg. Group B (Neurodynamic sliders) – In this group subjects received Neurodynamic Sliders. The procedure of this intervention was patient has to be half lying position. The concurrent movement of hip flexion, knee flexion and dorsiflexion was altered dynamically by concurrent movement of hip extension, knee extension and plantar flexion. This movement was for 10 repetitions in the dominant leg. After the intervention, post test scores of AKE and Agility T test were measured and noted.

4. Discussion

The study findings indicates that both Neurodynamic tensioners and sliders significantly improved hamstring flexibility ($p<0.50$). The mean difference in group A was 0.32 and group B was 0.77 saying group B showed a slight increase in AKE than Group A. This goes in hand with, Y Castellote Caballero who concluded that Neurodynamic sliding technique was effective in increasing hamstring flexibility in healthy, male soccer players, Jaemyoung park who suggested that neurodynamic sciatic nerve sliding technique improves hamstring flexibility and postural balance, S Sharma et al concluded that Neural sliders and tensioners are both effective in increasing hamstring flexibility as an adjunct to static hamstring stretching when compared to static stretching alone. No neural techniques proved to be superior over the other. Fidel et al. applied tensioner mobilization in the slum position on 27 healthy subjects. They reported an increase of about 5.6 degrees in the range of AKE after tensioner mobilization.

The improvement in Active knee extension angle (AKE) can be justified by that neural mechanosensitivity is increased when the nerve gets adherent and there occurs a protective contraction of hamstring muscle leading to tightness. The neural mobilisation decrease neural mechanosensitivity and thus improves the range of motion.

Both Neurodynamic sciatic nerve tensioners and sliders showed improvement in Agility T test. The mean difference of group A was 0.11 and group B was 0.23 saying group B showed a slight increase than group A. This goes in hand with DabolkarTejashree who concluded that neural mobilization techniques were effective in improving agility of lower extremity.

The results of this study showed that there exist a statistically significant difference among the two groups ($p<0.05$) and on analysis Group B treated with Neurodynamic sciatic nerve sliders showed a slight beneficial result than Group A treated with Neurodynamicsciatic nerve Tensioners. This can be better explained by the fact that sliding techniques involves the combination of movements that result in elongation of the nerve bed at one joint, while reducing the length of the bed at an adjacent joint. These have a biomechanical effect on the nervous system and are less aggressive than tension technique. So this study says, both Neurodynamic sciatic nerve Tensioners and Sliders are effective in increasing hamstring flexibility and Agility. In sports or clinical settings, either of the two neural mobilization techniques can be used along with static stretching if the intention is to increase hamstring flexibility and performance in asymptomatic individuals.

5. Conclusion

This study demonstrated that both the Neurodynamic sciatic nerve Tensioner and Slider technique significantly improved hamstring flexibility and Agility. But Sliders showed a slight change compared to Tensioner. These data suggest that both the Tensioners and sliders may be useful in increasing hamstring flexibility and agility.

6. Future Scope

- Study can be done in long duration.
- The sample size of the study can be increased to get a better result.
- Study can include female subject.
- Players or athletes can be taken as sample for the study.

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