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Research Article

COMPARISON OF EFFECTIVENESS OF NEURODYNAMIC TENSIONING TECHNIQUE AND MULLIGAN BENT LEG RAISE TECHNIQUE ON KNEE EXTENSION ANGLE IN INDIVIDUALS HAVING HAMSTRINGS TIGHTNESS

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Neurodynamic Tensioning Technique, Mulligan Bent Leg Raise, Active Knee Extension test, Straight Leg Raise test, Range of Motion, Muscle Tightness, Hamstring flexibility.

A B S T R A C T

Aims: To study and compare the effectiveness of Neural Tensioning Technique and Mulligan Bent Leg Raise Technique on hamstring flexibility in individuals having hamstrings tightness.
Background: The hamstrings are a two-joint muscle which flex the leg at the knee joint and extend the thigh at the hip joint. Hamstring tightness i.e. poor flexibility is a common condition found in both symptomatic and asymptomatic subjects. Flexibility can not only be influenced by muscle elasticity but also by the nervous tissue extensibility. Techniques Neurodynamic Tensioning Technique and Mulligan Bent Leg Raise are well known and commonly used to reduce hamstrings tightness.
Outcome Measures: Active knee extension test and Passive Straight Leg Raise test.
Results: There was statistically significant difference between means of pre and post intervention of both the outcome measures i.e. Active Knee Extension and Passive Straight Leg Raise Range of Motion within the groups but there is no statistically significant difference in post intervention means between the groups.
Conclusion: It is concluded that both Neurodynamic Tensioning Technique and Mulligan Bent Leg Raise technique are effective on improving hamstring flexibility for asymptomatic individuals. However, there is no significant difference in improvement in hamstring flexibility between the groups.

INTRODUCTION

The hamstrings are a two-joint muscle bulk comprises biceps femoris longus and brevis, forming the lateral mass of hamstrings, and the semimembranosus and semitendinosus, making up the medialmass. As a unit, the hamstrings flex the leg at the knee joint and extend the thigh at the hip joint. They are also rotators at both joints. [1] In addition, hamstrings reportedly add stability of the knee joint. The hamstrings provide active resistance to anterior glidingoftibiaon the femur. They are also active during normal locomotion. The most prominent period of activity is at the change over between the swing and stance periods of the gaitcycle.[2] The hamstring muscles are commonly linked with movement dysfunction at the lumbar spine, lower limbs, pelvis and have been coupled with low back pain and gait abnormality.[3] The causes of hamstring injuries are complex and multifactorial. Many predisposing factors or causes for hamstring injury have been suggested within the literature, including: insufficient warm-up, poor flexibility, muscle imbalance, neural tension and previous injuries. [4,5]

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Inadequate extensibility of the hamstrings appears to be one of the more commonly accepted etiology of hamstring strain injury. [5]

Particularly in the field of rehabilitation, flexibility of the hamstrings muscle is important in postural balance, complete maintenance of the range of motion of knees and hips, injury prevention and optimization of musculoskeletal function. Hamstring tightness i.e. poor flexibility is a common condition found in both symptomatic and a symptomatic subjects. [2] During normal daily activities, complete contraction and stretching rarely occurs therefore hamstrings are rarely put through their full physiological amplitude. Therefore, chances of this muscle going into tightness are more in individuals not participating in any daily stretching program. [7]

Various factors such as viscoelastic properties of muscle, stretch tolerance and neurodynamics can contribute to hamstring flexibility. Functional adaptations of these factors can possibly result in restricted range of motion of knee extension. [6]

It is also stated that the contractile tissue and also the non-contractile tissues such as deep fascia, soft tissues surrounding the joint and the neurological tissues can be the cause of soft tissues restriction which can limit the range of motion.

A variety of stretching activities has been presented in the literature in order to regain or maintain muscle flexibility and avoid a decrease in ROM that can impair functional activities in an individual. Different methods used to increase hamstring flexibility are ballistic stretching, dynamic stretching, active stretching, passive stretching, static stretching, PNF stretching, muscle-energy technique, neural mobilization and active release technique.[8] Fasen *et al* states that the flexibility can not only be influenced by muscle elasticity but also by the nervous tissue extensibility. [9] Additionally, the hamstrings act as a mechanical interface surrounding the sciatic nerve. During daily activities, the sciatic nerve is exposed to constant pressure during prolonged sitting, standing and other activities resulting in hamstring tightness. [8]

Nerve adhesions in the hamstring could modify neurodynamics and can cause abnormal mechanosensitivity of the sciatic nerve; which might influence hamstring flexibility. These modifications could limit hamstring muscle length in normal healthy individuals[6,8] and in individuals with previous hamstring injuries. [6] Thus reduced hamstring flexibility as demonstrated by limited range could be due to altered neurodynamics affecting the sciatic and tibial nerve. [5]

Neurodynamic interventions, termed as Neural Mobilization (NM) techniques are widely used to assess, and improve, the mechanical and neurophysiological integrity of the peripheral nerves [10] in clinical populations.[11] Neural mobilization is believed to decrease this altered mechanosensitivity and it is possible that the inclusion of these interventions in the management of hamstring flexibility could be beneficial.[12] Butler *et al*[11] proposed using either the slider or tensioner neural mobilization treatment techniques. These techniques include set of combinations of joint movements that promote either neural tensioning (i.e. through movement of the nerve endings in opposite directions) or sliding (i.e. through movement of nerve endings in the same direction). [13] The tensioner mobilization involves elongating the whole length of the nerve tract; that is, it attempts to apply tension along the whole neural axis. Tensioning mobilization for sciatic nerve can be given in different positions like in supine straight leg raise position (Martins *et al*), and mobilizing in slump position i.e. given in high sitting. The latter has been used in this study. Previous studies have examined the effect of a tensioner neural mobilization alone on lower limb range of motion (ROM) in normal subjects.

The Mulligan's bent leg raise (BLR) technique is a painless method of stretching. Several Studies on Mulligan's techniques have proved their efficacies in improving Hamstrings flexibility. It has been used as a method to achieve greater range of straight leg raise by increasing flexibility of hamstring muscles. This technique was designed to restore altered activation of hamstring muscles. [14]

Literature regarding the immediate effects of Neurodynamic techniques and Mulligan Bent Leg Raise technique on Hamstrings Flexibility shows a contradictory result, with some stating no difference between both the techniques (Babu *et al*, Tambekar *et al*) and few stating significant difference between both the techniques (Shinde *et al*).

Need of Study

Poor hamstrings flexibility is associated with low back pain in both adolescents and adults and in subjects without lower-quarter symptoms. It is also known to decrease the performance in athletes and also a risk factor for the development of patella tendinopathy and patellofemoral pain and symptoms of muscle damage following eccentric exercises, also a significant predictor for sustaining a lower extremity overuse injury. Mulligan Bent Leg Raise and Neurodynamic Tensioning Technique individually has proved to produce a significant improvement in increasing hamstrings flexibility.

There have been studies done to check immediate effectiveness of both the techniques but has yielded a contradictory result. Therefore, the present study focuses over the comparison of effectiveness of Neurodynamic Tensioning Technique and Mulligan Bent Leg Raise on muscle flexibility in one week in individuals having hamstrings tightness.

Aims: To study and compare the effectiveness of Neural Tensioning Technique (NTT) and Mulligan Bent Leg Raise Technique (MBLR) on hamstring flexibility in individuals having hamstrings tightness.

MATERIAL AND METHODOLOGY

***Study design**:* Comparative study

***Sample population**:* Individuals having Hamstrings tightness between 18 - 25 years

***Duration of study**:* 12 months

Type of Sampling: Simple Random Sampling

***Source of sampling**:* Metropolitan City

***Sample size**:* 60

Selection criteria

Inclusion criteria

1. Asymptomatic participants aged 18-25 years
2. Male and Female
3. Active knee extension loss more than 20˚ with hip in 90˚ flexion
4. Passive straight leg raise less than 75˚
5. Body mass Index 18.5- 24.9kg/m^2
6. Subjects willing to participate.

Exclusion Criteria

1. A history of trauma, fractures, dislocations, muscle imbalance or surgery inthe pelvis and/ or lower limb
2. Acute Hamstringinjuries
3. Hypermobility of lower limbjoints
4. Nerve lesions of lowerlimb
5. Acute or chronic low back pain
6. Any other musculoskeletal injuries
7. Recreational athletes
8. Currently undergoing any rehabilitation program

Outcome Measures

1. Active Knee Extension Test by Universal Goniometer

2. Passive Straight Leg Raise by Universal Goniometer

Procedure: Approval of the Ethical Committee and Head of the institution was obtained prior to commencing the study. Participants were screened according to the inclusion and exclusion criteria. The study procedure was explained to the participants and informed written consent was taken from them.

Data record sheet including demographic details of participants, anthropometric details, dominant leg (by asking the patient to kick a ball) [15] and pre AKE and PSLR values were taken. Randomization: Simple Random Sampling. The assignment of subjects to the two groups was performed randomly using chit method– Group A or Group B.

Group A was given Neural Tensioning Technique
Group B was given Mulligan Bent Leg Raise Technique.

Both the groups completed their 3 treatment sessions on alternate days for 1 week. Recording of outcome measures i.e. Active Knee Extension and Passive Straight Leg Raise was done before initiation of treatment and approximately after one hour of post intervention at last treatment session.

Intervention

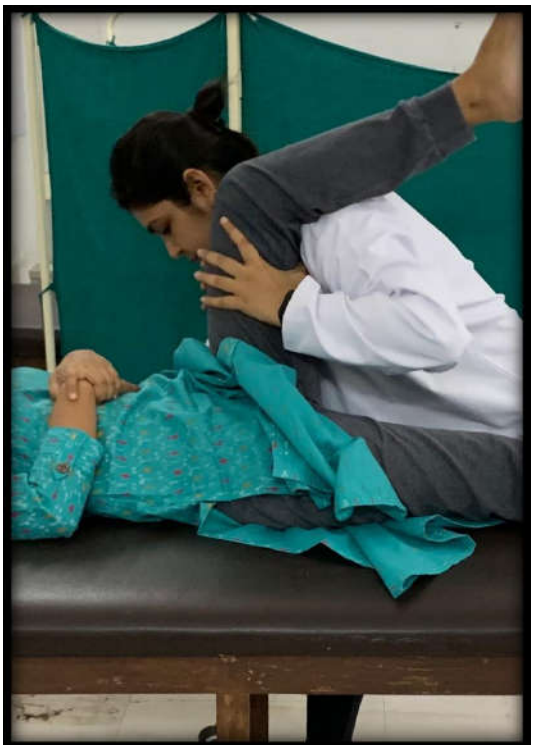
Group A: Group A was given Neural Tensioning Technique.

Neurodynamic Tensioning Technique (NTT): Participants received NTT for the Sciatic Nerve. The NTT was performed sitting on a sturdy object at a height which did not allow foot contact with the floor. With the thighs supported, legs flexed, and popliteal fossae touching the table edge, the subjects were asked to sit with their trunk in thoracic flexion (slump) as far as possible and while maintaining that posture, they were asked to perform alternating movements of knee extension/ankle dorsiflexion with cervical flexion, and knee flexion/ankle plantar flexion with cervical extension. Participants performed these active movements for about 30 reps. [16,17,18]

Neurodynamic Tensioning Technique

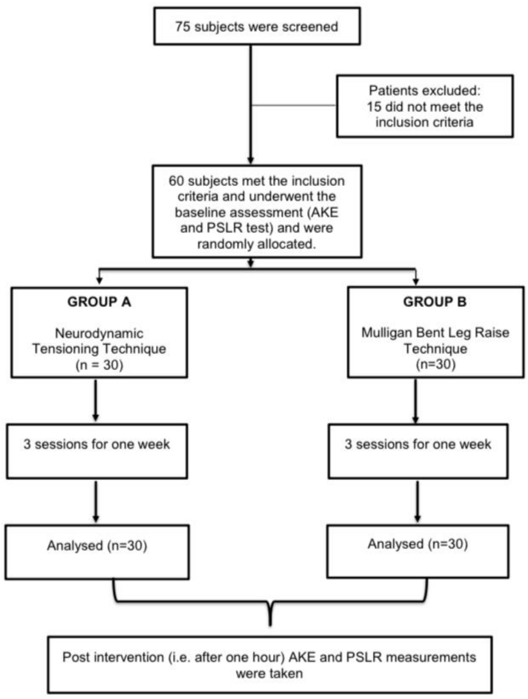
Group B: Group B was given Mulligan Bent Leg Raise Technique

Mulligan Bent Leg Raise Technique: Participant was in supine lying on a high couch with the investigator in walk stand position lateral to the leg, which is being stretched. Hip and Knee of the side to be stretched is bent at 90°– 90°. Investigator placed the participant's flexed knee over his shoulder, the popliteal fossa of the participant's knee was resting on the investigator's shoulder.



Mulligan Bent Leg Raise Technique

SCHEMATIC REPRESENTATION OF METHODOLOGY



A distraction (longitudinal traction force along the long axis of femur) was applied at the lower end of femur and the participant were asked to push the investigator's shoulder with his or her leg followed by voluntary relaxation. At this point of relaxation, the investigator pushed the bent knee up as far as possible in the direction of the shoulder on the same side in a pain free range. Three repetitions of pain-free, 5 s, submaximal isometric contraction of the hamstrings, were performed in five progressively greater positions of hip flexion.[19] It was ensured that there was no pain during the procedure, if it was painful the direction of the leg raise was altered medially or laterally. The contra lateral leg was kept relaxed and limb brought back to the neutral position. The traction was maintained throughout the technique. [20]

Statistical Analysis

The data was entered using Microsoft Excel Version 2016 and was analyzed using the statistical package for social science (SPSS) software trial version 19. Data was tested for normality using the Shapiro Wilk Test. Level of significance was set at level less than 0.05 ($p<0.05$). For both the groups, within the group comparison between AKE and PSLR pre values and post values was done using Paired t test as data was passing normality. Between the group comparison after one week for both the outcome measures was done using Unpaired t test.

In the entire study, the p value less than 0.05 are considered to be statistically significant. All the results are shown in tabular as well as graphical format to visualize the statistical significant differences clearly.

RESULTS

A total number of 60 subjects with hamstrings tightness were studied on Active Knee Extension and Passive Straight Leg Raise, out of which 31 were females and 29 were males. They were allotted into two groups: Group A: Neurodynamic Tensioning Technique (n=30) and Group B: Mulligan Bent Leg Raise Technique (n=30). The demographic details of both the groups is shown in Table 1.

Demographic Data

Table 1

	GROUP A (Mean±SD)	GROUP B(Mean±SD)	p value
Age	21.53± 2.04	22.70± 1.91	0.541
Height in cm	157.17 ± 3.2	156.33 ± 3.1	0.324
Weight in kg	61.93 ± 4.2	60.90 ± 4.0	0.253
BMI in kg/cm^2	25.04 ± 1.37	24.90 ± 1.44	0.673

Comparison of Pre measurements between the Groups

Table 2

Sr no.	Variables	Group A (NTT)	Group B (MBLR)	p value
1.	Active knee extension (AKE)	54.16 ± 5.1	53.07 ± 4.7	0.400
2.	Passive Straight leg raise (PSLR)	54.26 ± 3.8	54.30 ± 3.8	0.974

Table 2: shows that there is no significant difference in baseline readings between two groups in outcome measures of Active knee extension test and Passive Straight leg raise test, p value being 0.400 for Group A and 0.974 for Group B. Hence, these two groups can be compared.

Within the group comparison for Group A (Neurodynamic Tensioning Technique) and Group B (Mulligan Bent Leg Raise Technique)

The Table 3 shows statistically significant improvement in both the groups (i.e. reduction in angle) [p = 0.000 (< 0.0001)] in knee extension angle i.e. improvement in hamstrings flexibility post one week of neurodynamic tensioning technique in both the outcome measures.

Table 3

	Outcome Measures		Mean	SD	Mean Difference	SD of Difference	p value
Group A	Active Knee Extension	Pre Intervention	54.16	±5.15	16.40	±2.90	.000
		Post one week of intervention	37.76	±3.72			
	Passive Straight Leg Raise	Pre Intervention	54.26	± 3.88	-10.90	± 2.60	.000
		Post one week of intervention	65.16	± 3.48			
Group B	Active Knee Extension	Pre Intervention	53.07	± 4.71	8.03	±1.542	.000
		Post one week of intervention	45.03	± 4.48			
	Passive Straight Leg Raise	Pre Intervention	54.30	± 3.81	-8.20	± 1.78	.000
		Post one week of intervention	62.50	± 3.39			

Between the group comparison of both intervention techniques

The **Table 4** shows statistically significant improvement [p = 0.000 (< 0.0001)] in both the outcome measures i.e. improvement in hamstrings flexibility post one week of between Group A and Group B.

Outcome Measures		Mean	SD	Mean Difference	p value
Active Knee Extension	Group A	16.40	± 2.90	8.36	0.000
	Group B	8.03	± 1.54		
Passive Straight Leg Raise	Group A	10.90	± 2.60		0.000
	Group B	8.20	± 1.78	2.70	

DISCUSSION

The present study was conducted to compare the effect of Neurodynamic Tensioning Technique and Mulligan Bent Leg Raise Technique on knee extension angle in Individuals having Hamstrings Tightness. Overall results of this study showed that Group A and Group B both demonstrated significant improvement in hamstrings flexibility measured by active knee extension test and passive straight leg raise test post one week of intervention.

The improvement in hamstrings flexibility post NTT could be possibly because of excursion of the sciatic nerve in the posterior thigh during slump mobilization, potentially reduced mechanosensitivity of the neural tissues or increase in stretch tolerance and modification of sensation. [5,6] Findings are attributed to the outcomes of mobilizing nervous system which has a mechanical effect that affects the vascular dynamics, axonal transport systems and neuromeningeal mechanosensitivity.[21] Mechanosensitivity is the chief mechanism by which the nervous system becomes a source of pain with movements and postures. It has been proposed that due to Neurodynamic stretching there is decrease in the mechanosensitivity of the neural tissues which reduces intrinsic pressures on the neural tissues and promotes optimum physiologic function and that results in improvement of hamstring flexibility. [22,23]

Results of our study is supported by the study done by Pratiksha G *et al* in 2017 who stated that neural slump stretch technique is more effective than static stretch technique in immediate improvement in hamstring flexibility. [24]

Another study, done by Ahmed *et al* in 2016 proposed that an increase in hamstrings flexibility can be explained as when tension is applied to the nervous system, there is a reduction of the cross-sectional area and increase in pressure in the nerve, which result in movement of the sciatic nerve together in compliance with the hamstring muscle, resulting in increased flexibility. [8]

Another study conducted by Sharma *et al* in 2016 stated that both the technique of neurodynamic mobilization i.e. sliders and tensioners effectively improve hamstrings flexibility andhas statistically non-significant difference between them but has statistically significant difference from static stretching. [6]

In our study, Neurodynamic tensioner technique was used rather than a slider technique because our study wants to assess the effect of stretch rather than movement (which is a part of slider) in altering our outcome measures also, there are very few literatures present in comparing tensioner mobilizations with other interventions.

Lastly, the results of this study reinforce previous studies that demonstrated improvement in lower quarter flexibility following different neural mobilization techniques such as Neurodynamic sliding mobilization (Castellote-Caballero *et al*., 2014)[12], active slump tensioners (Webright *et al*., 1997)[18] and active-assisted ankle-biased neural mobilization (Fasen *et al*., 2009)[9], however with different outcome measures.

Improvement in hamstrings flexibility could be because Mulligan's BLR technique uses passive flexion at the hip which in turn results in caudal loading of the lumbosacral nerve roots and sciatic nerve in the pelvis, followed by active hip extension. During hip extension, there is unloading of these neural tissues, and they move in the cranial direction. [25,26]With hip flexion during BLR, there is obligatory lumbar flexion. With this, the lateral intervertebral foramina and central canal open further facilitating caudal movement of the neural structures.[27] This movement of neural structures improves it mechanics. Improved mechanics of the neural structures could be one mechanism for improvements noted post Mulligan Bent Leg Raise.

Mulligan BLR also involves isometric contraction of hip extensors followed by stretch of the same muscles also referred to as Post Isometric Relaxation. Improvements noted in Group B (MBLR group) could also be attributed to the effect of isometric contraction on the connective tissues. Combination of contraction and stretches may be responsible for improving the viscoelasticity which in turn improves tissue extensibility. [27]

Another beneficial effect of the Mulligan BLR technique might be change in stretch tolerance of the hamstrings. Goeken and Hof et.al demonstrated increase in range of Straight Leg Raise following stretching is intermediated by the increase in hip flexion and pelvic rotation as well as hamstring length and not related to increase to increased hamstring viscoelastic properties. [28]

In 2017 Venkitaraman *et al* concluded that both the technique significantly improves hamstrings flexibility wherein Mulligan Bent Leg Raise had better efficacy than PNF Agonist contraction in improving hamstrings flexibility in same number of sessions. They have attributed their results i.e. improvement in Mulligan Bent Leg Raise group to the principle of autogenic inhibition which is caused by activation of Golgi Tendon Organ (GTO) – a musculotendinous proprioceptor. When the hamstrings muscle contracts, the GTO is activated and responds by inhibiting this contraction (reflex inhibition) and contracting the antagonist muscle group. Thus, allowing the hamstrings muscle to relax and stretch further easily.[29]

Lastly, study conducted by Weppler and Magnusson in 2010 proposed a sensory theory suggesting that increase in muscle extensibility are due to modification of sensation only, the length increases are transient and mainly due to changes in viscous behaviour of a muscle. Increase in muscle extensibility post single stretching session and after short term (3- 8 weeks) are also attributed to alteration in perception of stretch. [30]

Therefore, in order to get muscular changes flexibility program of 3-8 weeks or more than 8 weeks is required. In current study, one-week protocol was used to assess the effect of flexibility program on hamstrings flexibility. Currently used both the techniques improved sciatic nerve excursion with both the technique having similar effect on hamstrings muscle.

Hence, according to results it could be stated that in one-week flexibility program, in addition to alteration of stretch perception, nerve gets mobilized first and yields flexibility gains when compared to real muscular length changes i.e. changes in muscle viscoelastic properties.

Limitations

- Subjects with 18-25 years of age were considered for study thus results cannot be generalized to all age group.
- Participants were asymptomatic subjects and, therefore, findings may not apply to patients with pain and pathology.

Clinical implications

- Neurodynamic Tensioning Technique which is an active stretching technique once mastered can be performed by the patients themselves as a home program for improving hamstrings flexibility.
- Also these neural-biased techniques can be used as a part of prevention or rehabilitation program.

CONCLUSION

The present study concludes that both Neurodynamic Tensioning Technique and Mulligan Bent Leg Raise Technique are effective in improving hamstrings flexibility in asymptomatic individuals post one week of intervention

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References

1. Drake R, Vogl W, Mitchell AWM. Grays Anatomy for Students. Edinburgh: Churchill Livingstone; 2004.

2. Oatis C. Kinesiology: The Mechanics and Pathomechanics of Human Movement. 2nd ed. Baltimore: Lippincott Williams & Wilkins, 2009.
3. Koli B, Anap D. Prevalence and severity of hamstring tightness among college student: a cross sectional study. *International Journal of Clinical and Biomedical Research*.2018;4(2):65-68.
4. Verrall GM, Slavotinek JP, Barnes PG, Fon G, Spriggins A. Clinical risk factors for hamstring muscle strain injury: a prospective study with correlation of in jury by magnetic resonance imaging. Br J Sports Med. 2001; 35:435–9.
5. Castellote-Caballero Y, Valenza MC, Martín-Martín L, Cabrera-Martos I, Puentedura EJ, Fernandez-de-las-Penas C. Effects of a neurodynamic sliding technique on hamstring flexibility in healthy male soccer players. A pilot study. Physical Therapy In Sport. 2013;14(3):156-62.
6. Sharma S, Balthillaya G, Rao R, Mani R. Short term effectiveness of neural sliders and neural tensioners as an adjunct to static stretching of hamstrings on knee extension angle in healthy individuals: A randomized controlled trial. Physical Therapy in Sport. 2016; 17:30-37.
7. Talapalli R, Sheth M. Comparison of Muscle Energy Technique and Post Isometric Relaxation on Hamstring Flexibility in Healthy Young Individuals with Hamstring Tightness. *International Journal of Health and Rehabilitation Sciences*. 2014;3(2): 65-68.
8. Ahmed A, Samhan A. Short term effects of neurodynamic stretching and static stretching techniques on hamstring muscle flexibility in healthy male subjects. *International Journal Medical Research Health Science*. 2016;5(5):36-41.
9. Fasen J, Connor A, Schwartz S, Watson J, Plastaras C, Garvan C*et al*. A randomized controlled trial of hamstring stretching: comparison of four techniques. *Journal of Strength and Conditioning Research*. 2009;23(2):660-667.
10. Shacklock M., "Neurodynamics," Physiotherapy, vol. 81, no. 1,pp. 9–16, 1995.
11. Butler, D.The Sensitive Nervous System, Noigroup Publications, Adelaide, Australia, 2000.
12. Castellote-Caballero Y, Valenza M, Puentedura E, Fernández-de-las-Peñas C, Alburquerque-Sendín F. Immediate effects of neurodynamic versus muscle stretching on hamstring flexibility in subjects with short hamstring syndrome. *Journal of Sports Medicine*. 2014;14(3), 156-162.
13. Coppieters M, Hough A, Dilley A. Different nerve-glidingexercises induce different magnitudes of median nerve longitudinal excursion: an in vivo study using dynamic ultrasound imaging. *Journal of Orthopaedic and Sports Physical Therapy*. 2009; 39(3):164-171.
14. Mulligan BR. Other spinal therapies. In: Manual therapy: ''nags'',''snags'', ''mwms'' etc. 4th ed. Wellington: Plane View Services; 1999.
15. Melick N, Meddeler B, Hoogeboom T, Sanden M, Cingel R. How to determine leg dominance: The agreement between self-reported and observed performance in healthy adults. PloS one. 2017;12(12):1-9.
16. Herrington L. Effect of different neurodynamic mobilization techniques on knee extension range of motion in the slump position. *Journal of Manual & Manipulative Therapy*. 2006; 14(2):101-107.
17. Pratiksha G, Bharati A. Comparison of Immediate Effect on Hamstring Flexibility Using Non Ballistic Active Knee Extension in Neural Slump Position And Static Stretch Technique. *International Journal of Physiotherapy and Research*. 2017;5(6):2425-2431
18. Webright WG, Randolph BJ, Perrin DH. Comparison of nonballistic active knee extension in neural slump position and static stretch techniques on hamstring flexibility. *Journal of Orthopaedic & Sports Physical Therapy*. 1997 Jul;26(1):7-13.
19. Hall T, Hardt S, Schafer A, Wallin L. Mulligan bent leg raise technique-a preliminary randomized trial of immediate effects after a single intervention. Manual therapy. 2006; 11(2):130-135.
20. Hing W, Hall T, Rivett D, Vicenzino B, Mulligan B. The Mulligan Concept of Manual Therapy: textbook of techniques. Australia: Elsevier; 2015.
21. Butler D. Mobilisation of the Nervous System. Churchil Livingstone: Melbourne; 1991.
22. Shinde S, Kanase S. Effect of Mulligan Bent Leg Raise versus Neural Mobilization on Hamstring Tightness in College Students. IOSR *Journal of Dental and Medical Sciences*. 2017; 16(3):59-63.
23. McHugh M, Johnson C, Morrison R. The role of neural tension in hamstring flexibility. *Scandinavian Journal of Medicine & science in sports*. 2012; 22:164-169.
24. Pratiksha G, Bharati A. Comparison of Immediate Effect on Hamstring Flexibility Using Non Ballistic Active Knee Extension in Neural Slump Position and Static Stretch Technique. *International Journal of Physiotherapy and Research*. 2017;5(6):2425-2431.
25. Butler D. Mobilisation of the Nervous System. Churchil Livingstone: Melbourne; 1991.
26. Shacklock M. Clinical neurodynamics. 1st ed; 2005.
27. Chaitow L. Muscle Energy technique-advanced soft tissuetechnique. 3rd ed; 2006.
28. Goeken L, Hof H. Instrumental straight leg raising: results in patients. Archives of Physical Medicine and Rehabilitation 1994; 75(4):470-7.
29. Venkitaraman V, Agni P. Effect of Mulligan Bent Leg Raise Versus PNF Agonist Contraction on Hamstrings Flexibility in Healthy Females. *International Journal of Science and Research*. 2017;6(9):1566-1570.
30. Weppler and Magnusson. Increasing Muscle extensibility: A matter of increasing Length or Modifying Sensation, Physical Therapy. 2010; 90(3):438-449.

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