Research

Comparative Study of the Effects of Neurodynamic Sliding *vs* Suboccipital Muscle Inhibition Technique on Flexibility of Hamstring in Asymptomatic Subjects with Hamstring Syndrome

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ABSTRACT

Objective

The purpose of this study is to research the effects of the Neurodynamics sliding (NDS) and sub-occipital muscle inhibition technique (SMI) on flexibility of hamstring in asymptomatic subjects with hamstring syndrome.

Method

According to finger floor test and SLR test thirty male subjects were selected subjects were randomly allocated to Neurodynamics sliding group and sub-occipital muscle inhibition group of 15 each. Neurodynamic sliding and Sub occipital inhibition technique were applied to the groups. For analysis straight leg raise (SLR) finger floor test (FFT) and range of motion (ROM) of knee joint were used. Outcome measures were assessed before and after intervention at end of two weeks.

Result

There is a significant change in SLR, FFT and ROM measures in both SMI and NDS groups. When compared the Neurodynamics sliding group measures show significant changes than the sub-occipital muscle inhibition group.

Conclusion

Application of NDS& SMI to persons with short hamstring syndrome resulted in increases in flexibility of the hamstring. However the NDS technique was more effective.

Keywords

Neurodynamic sliding; Sub occipital inhibition; Hamstring flexibility; Myofascial release; SLR; FFT

Introduction

Hamstring syndrome is a gluteal sciatic pain, in which post traumatic or congenital hard fibrotic bands irritate sciatic nerve at the insertion site of hamstring muscles to ischial tuberosity. It is caused by pressure on the sciatic nerve in the hip, by a fibrous tissue that extends between two hamstring muscles which can lead to hamstring tightness and reduced flexibility.

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Increases in tissue flexibility may result, not from affecting the mechanical properties of the muscle being stretched, but from changes in the individual's perception of stretch or pain. The point of limitation in hamstring range may increase, not because of changes within the muscle structure itself but rather because the individual experiencing the stretching may adopt a new stop point for limitation in hamstring range based on altered perceptions of stretch and pain. Increases in muscle flexibility after stretching were likely due to the modified sensation. Changes in the mobility of the nervous system (neurodynamics) achieved through movement and stretching could modify such sensations [1].

Decreased hamstring flexibility as evidenced by limited range in the passive straight leg raise test (SLR) could be due to altered Neurodynamics affecting the sciatic, tibial, and common fibular nerves [2-8]. Altered posterior lower extremity Neurodynamics could arguably influence resting muscle length and lead to changes in the perception of stretch or pain. Providing movement or stretching could lead to changes in the Neurodynamics and modification of sensation and could help to increase in flexibility [9-14].

Neurodynamics sliding intervention are thought to decrease neural mechanosensitivity. Providing movement and stretching could do changes in the Neurodynamics and modification of sensation which may help to increase in flexibility. Other intervention to increase hamstring flexibility is Sub-occipital Muscle Inhibition Technique. The sub-occipital muscles are involved in the postural control. Release of the muscle fascia allows greater stretching and reduces the tone of the knee flexors (hamstring muscle) owing to the high density of neuromuscular bundles in the sub-occipital muscles. The tone of the sub-occipital muscle is decreased (passively, with a fascial treatment or with active movement) which may lengthen the hamstring muscles and the amplitude of the hip flexion will be greater. Sub-Occipital Muscle Inhibition Technique (SMI) is used to release myofascial restriction of sub-occipital muscles [15-20].

The sub-occipital muscles are four small muscles attaching at either the C1 (atlas) or C2 (axis) vertebrae – from either the spinous or transverse processes. All but one of these muscles, obliquus capitis inferior, go on to attach to the base of the occiput. The Sub-occipital muscles function to rock and tilt the head into extension. The rectus capitis posterior major and obliquus capitis inferior assist in rotation of the head to the ipsilateral (same) side. Additionally, these muscles play a critical role in stabilization and fine movement control of the cranium on the atlas, and the atlas on the axis. Myofascial chains, Both the sub-occipitals and the hamstring musculature are included in the superficial back line. Addressing any of the structures in the superficial back line may have a positive effect of the entire line itself. If there is any tensions arise in the myofascial chain it will result to hamstring tightness as both hamstring and sub-occipital muscles belong to the posterior myofascial chain. The interest of the study is to find out whether Sub-occipital Muscles inhibition technique has any effects in young subjects with hamstring syndrome as there is scarce research regarding this technique and to find out the effectiveness of Neurodynamics Sliding technique on flexibility of the hamstring in subjects with hamstring syndrome in young college students. The aim of this study is to compare the effects of Neurodynamics Sliding technique and Sub-occipital Muscle Inhibition technique on flexibility of hamstring in subjects with hamstring syndrome.

Methodology

Study design is Quasi experimental and Comparative study type. Sampling method is Random sampling Sampling size is of 30 males. Study duration is for Two weeks

Study setting: SRM College of Physiotherapy, SRM University, Kattankulathur, Kanchipuram district, Tamil Nadu.

Inclusion criteria: subjects who were willing to participate in the study, Unilateral and bilateral short hamstring syndromes. Subjects age between 18-25, males students with SLR <80 degree and Subjects who are unable to do finger floor test (FFT). Exclusion criteria: Hamstring injury within the past year, subjects exceeding 80 degree in the initial SLR test, History of neck trauma, neck symptoms, History of fracture in any parts of the body, History of neurological or orthopaedics disorders, subject with diagnosis of herniated disk, low back pain in the last sixth month & Body mass index (BMI) lower than 20kg/cm² or higher than 30kg/cm². 30 male subjects were selected according to the inclusion criteria and exclusion criteria. The study population comprise of young adult students following their studies at SRM

College of Physiotherapy, SRM University. The samples are randomly divided into two groups as Neurodynamics Sliding technique (group1) and Sub-occipital Muscle Inhibition technique (group2). Initially a proper instruction about the procedure and benefits of the study is given to the subjects and informed consent was obtained.

Intervention

Group 1: Neurodynamic Sliding Technique

Subjects in the Neurodynamic Sliding group received sciatic Neurodynamics slider performed in supine and the therapist standing beside these subjects. The objective of the technique is to produce a sliding movement of neural (sciatic) structure relative to their adjacent tissue. Slider involve the application of movement /stress to the nervous system proximally while releasing movement /distally and then reversing the sequence. Subjects are supine with their neck and thoracic spine supported in a forward flex position. Concurrent hip flexion, knee flexion and ankle dorsiflexion and alternated dynamically with concurrent hip extension, knee extension and ankle plantar flexion. The therapist alternate the combination of movement depending on the tissue resistance level and this technique is given passively and is performed for 180 sec or 3 minutes (approximately 25th repetition) on their dominant lower limb.

Group 2: Suboccipital Muscle Inhibition Technique

The SMI technique is use as the intervention technique with the subject in supine and the eyes close, therapist seat behind the subject´s head with his elbow resting on the surface of the bed and place both the palm of his hand beneath the head of the subject; with the palm facing upwards, the finger flexed and the finger pads position on the posterior arch of the atlas. A force is applied on the atlas in the direction of the ceiling with slight traction in a cranial direction. The pressure was maintained for 2 minutes until tissue relaxation has been achieved. Intervention given for 6 days / week for 2 weeks.

Outcome Measures

Straight Leg Raise Test (SLR): The subjects were in supine, keeping the knee fully extended, the examiner flexes the subject's hip until reaching full flexion or until the subject experience discomfort and then the angle of hip was measured. The knee and ankle always remain in extension position. The passive SLR test recorded three times for each subjects using universal goniometer.

Finger Floor Test: subjects were asked to perform a maximum and progressive anterior flexion of the trunk, maintaining the knee straight and lengthening the arms with the palms parallel and the finger extended. Metric tape used to determine the distance from the distal part of the finger (middle finger) to the floor.

Measuring Of Hamstring Flexibility: The range of motion (ROM) of knee joint was performed with the subject in supine and arms across the chest angle was recorded using universal goniometer.

The Outcome measures were recorded at 1st day, 4th day, 8th day and 12th day.

Data Analysis

This is a pre-post comparative study between the effect of Neurodynamics sliding technique and sub-occipital muscle inhibition technique. Independent Samples T-test was used to compare between the groups and the result were considered if $p<0.05$. Data analysis was done by using the software SPSS 17. The mean and standard deviation of all the variables were analysed.

Results

Table 1 shows that the comparison between post-test of SLR for group1 and group2. There was no difference in the mean values between the two groups in post test1 (4th day assessment) SLR However the mean SLR value were significantly higher for both the groups in post-test2 (8th day assessment) of SLR, the mean value for group1 increased from71.66 to 80.60 and group2 increased from71.66 to 79.80 after the intervention. In post-test3 (12th day assessment) of SLR the mean value was greatly increase from 80.60 to 88.7333 for group1 and from 79.80 to 84.0667 for group2 after the treatment. The significant value in post test2 and post test3 of SLR is at $p<0.05$.

Table 2 shows that the comparison between post-test of FFT for group1 and group2. The result indicates that this intervention improved forward flexion of trunk, the significant value in post test2 (8th day assessment) and post test 3(12th day assessment) of FFT was at $p<0.05$.

In the post-test 2 (8th day assessment) of FFT, the mean value for group1 decreased from 5.76

to 3.40 and group2 decreased from7.40 to 5.56 after the intervention. In post-test 3 (12th day assessment) of FFT the mean value decreased from3.40 to 1.10 for group1 and from 5.56 to 3.66 for group 2 after the treatment.

Table 3 shows that the comparison between post-test of ROM for group 1 and group 2. The significant value in posttest1 (4th day assessment) and posttest 2 (8th day assessment) of ROM was at p<0.05 and there was no significance in posttest 3(12th day assessment) of ROM at p>0.05. In the posttest 2 of ROM the mean value of group1increased from 60.33 to 69.93 and from 56.73 to 63.13 for group 2. In the post-test 3 of ROM the mean value of group1 increased from 69.93 to 79.40 and from 63.13 to 68.93 for group 2 after the treatment. Therefore the result indicates that both Neurodynamics Sliding Technique and Sub-occipital Muscles Inhibition Technique have an effect on hamstring flexibility.

Discussion

This study tried to find out which treatment among Neurodynamics Sliding technique and Sub-occipital Muscle Inhibition technique effective in improving hamstring flexibility. Result shows that Neurodynamics Sliding group shows increased in hamstring flexibility which were assessed by passive SLR, FFT and ROM.

Neurodynamic Sliding technique has improved the flexibility. The increase in hamstring flexibility may be due to the influence of resting muscle length, decrease neural mechano sensitivity and changes in the individual´s perception of stretch or pain. These results proves that Sub occipital muscle inhibition technique has improved the hamstring flexibility. This change in flexibility may be due to suboccipital muscle stretch which would have affected the posterior myofascial chain. Schleip [3] consider that if the tone of the sub-occipital muscle is decreased (passively, with a fascial treatment or with active movement)

Table 1: Comparison of Post Test SLR between Neurodynamics Sliding Group and Suboccipital Muscles Inhibition Group.

GROUP1 VS	N	MEAN	Std. Deviation	Std. error	t	Significance
GROUP 2				mean		
SLR						
Post test1SLR					.000	0.28
GROUP1	15	71.6667	3.99404	1.03126		
GROUP2	15	71.6667	7.05759	1.82226		
Post test2SLR					.394	0.040
GROUP1	15	80.6000	3.90604	1.00854		
GROUP2	15	79.8000	6.82642	1.76257		
Post test3SLR					2.350	0.018
GROUP1	15	88.7333	3.84460	.99267		
GROUP2	15	84.0667	6.65976	1.71754		
P<0.05						

P<0.05

This table p is greater than 0.05 in the first post-test values of SLR between Group-1 and Group-2 subjects.

Table 2: Comparison of Post Test FFT between the Neurodynamics Sliding Group and Suboccipital Muscles Inhibition Group.

GROUP1 VS	N	MEAN	Std. Deviation	Std. error	t	Significance
GROUP2				mean	value	
FFT						
Post test1FFT						
GROUP1	15	5.7667	4.15704	1.07334	-.810	0.59
GROUP2	15	7.4000	6.61402	1.70796		
Post test2FFT						
GROUP1	15	3.4000	2.96528	.76563	-1.331	0.031
GROUP2	15	5.5667	5.56413	1.43665		
Post test3FFT						
GROUP1	15	1.1000	1.53762	.39701	-2.279	.00
GROUP2	15	3.6667	4.08248	1.05409		
P<0.05						

P<0.05

This table p is greater than 0.05, shows the post-test values of FFT between Group1 and Group2 subjects.

Table 3: Comparison of Post Test Room between the Neurodynamics Sliding Group and Suboccipital Muscles Inhibition Group.

GROUP1 VS GROUP2 ROM	N	MEAN	Std. Deviation	Std. error mean	T value	Significance
Post test1 ROM						0.32
GROUP1	15	60.3333	5.60187	1.44640	1.309	
GROUP2	15	56.7333	9.05907	2.33904		
Post test2 ROM						.021
GROUP1	15	69.9333	6.19293	1.59901	2.675	
GROUP2	15	63.1333	7.65195	1.97573		
Post test3 ROM						.446
GROUP1	15	79.4000	5.82850	1.50491	4.171	
GROUP2	15	68.9333	7.77787	2.00824		
P> 0.05						

P> 0.05

In this table p is greater than 0.05 in post-test which shows that there is no significant difference between post-test values of ROM between Group-1 and Group-2 subjects.

the length of the hamstring muscles and the amplitude of the hip flexion will be greater.

In comparison between post-test of SLR there was no significant difference in the mean values between the two groups in post test1 SLR which was 71.6667. However the mean value differences was seen between the two groups in second post-test of SLR, group1 was 80.60 and group2 was 79.80 after the intervention, in the third post-test of SLR the mean value was greatly increase in both groups. The mean value of the Neurodynamic Sliding group in Post-test SLR is 88.7333° which are higher than the Sub-occipital group which has a mean value of 84.0667°. There was no significance difference between the two groups at the beginning, however at the end of the study, both the groups were significantly improved SLR compared to their baseline values ($p<0.05$). Mean SLR values were significantly higher for both the Neurodynamic and groups. Much of the research on hamstring flexibility has focused on the varying modes of stretching such as static stretching, ballistic stretching etc. and also compared different stretch intensities and frequencies. Very few studies have examined the effects of neurodynamic sliding and Sub-occipital muscles inhibition interventions on hamstring flexibility and the result of this study can be seen as adding further evidence for the potential role of neural tissue mechanosensitivity and myofascial chain tightness in limiting the SLR.

Weppler and Magnusson suggested that such increases in tissue flexibility may result, not from affecting the mechanical properties of the muscle being stretched, but from changes in the individual's perception of stretch or pain. They suggested that the point of limitation in hamstring range may increase, not because of changes within the muscle structure itself but rather because the individual experiencing the stretching may adopt a-new stop point for limitation in hamstring range based on altered perceptions of stretch and pain. They referred to this as the ―sensory theory and proposed that increases in muscle flexibility after stretching were likely due to the modified sensation. Changes in the mobility of the nervous system (neurodynamics) achieved through movement and stretching could modify such sensations [21].

Observed changes in SLR following interventions may be more associated with increased tolerance to the uncomfortable stretch sensation rather than true changes to muscle elasticity. Although the results from this study do not provide information on the mechanisms for the observed changes, they do suggest that neurodynamic interventions can significantly increase SLR in the short term in healthy subjects with hamstring syndrome. This may be due to mechano sensitivity altered by neurodynamic technique as mechano sensitivity of the neural structures in the posterior leg, thigh, buttock, and vertebral canal may play a part in determining the flexibility of the hamstring muscles. Protective muscle contraction of the hamstring muscles found in the presence of neural mechanosensitivity may account for hamstring tightness.

Sub-occipital muscle inhibition technique group showed greater improvements in finger-floor distance test and straight leg raise. Suboccipital muscle inhibition technique might have release the myofascial chain on the back of the neck and resulted in increase of the flexion of the hip range of motion and increase in the finger floor distance test.

Result from this study shows that both Neurodynamics sliding intervention and Sub-occipital muscle inhibition intervention provides greater increase in passive SLR range of motion in subjects with hamstring syndrome. Comparing the post test of group1 and group 2 it is evident that group1 is more effective in increasing the flexibility of harmstring than Group 2. The results from this study suggest that Neurodynamics Sliding interventions can significantly increase SLR, FFT and ROM active knee extension more than Sub-occipital Muscle Inhibition intervention in healthy subjects with short hamstring syndrome.

Conclusion

This study indicate that both Neurodynamics Sliding intervention and Sub-occipital Muscle Inhibition intervention were effective in increasing hamstring flexibility as measured by the passive SLR, FFT and ROM and the Neurodynamics sliding intervention improved hamstring flexibility greater than Sub-occipital muscles inhibition intervention.

Limitation and Recommendation

Limitation of the study: Short duration of study, females were not included, young males with age between 18-25 only included in study and the long term effects are not assessed.

Recommendations: Research should be done on larger group of participants, athletes and patients with hamstring flexibility problem can be tested, comparison of male and female muscle flexibility can be assessed. Tools which assess mechano sensitivity can be incorporated in future studies.

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