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Original Research Article

EFFECTS OF VARIOUS THERAPEUTIC TECHNIQUES IN THE SUBJECTS WITH SHORT HAMSTRING SYNDROME

Pratik Vakhariya [1], Shruti Panchal *[2], Bhumi Patel [2].

[1] Assistant Professor at Shree B. G. Patel College of Physiotherapy, Anand, Gujarat, India.

*[2] Internee at Shree B. G. Patel College of Physiotherapy, Anand, Gujarat, India.

ABSTRACT

Background: Decreased flexibility of Hamstrings has a negative impact on the posture of lumbo-pelvic region and may serve as a cause of low back pain. It is also a major contributing factor for lumbar spine disorders, hamstring strains and other sports related injuries.

Aims: The objective of the study is to determine the effects of various therapeutic techniques such as Suboccipital Muscle Inhibition Technique, Neurodynemic sliding and Static Stretching Technique in the subjects with Short Hamstring Syndrome.

Materials and Methods: Present study conducted as Pre-test – Post-test Experimental study with a simple Random Sampling for a duration of 5 days/week *2 weeks. Outcome Measures of the study includes Passive SLR (<80^0) Active knee extension test (<125^0) Sit and reach test.

Group Wise Interventions: Group 1: Suboccipital muscle inhibition group. 20 subjects were given suboccipital muscle inhibition technique continuously for 2min. Group 2: Neurodynamic sliding group. 20 subjects were receive neurodynamic sliding technique passively for continuous 180 seconds. Group 3: Static stretching group. 20 subjects were receive static stretching 30 seconds *3 repetition. Group 4: Control group. 20 subjects who does not receive any treatment. Sample Size: 80 subjects were participated in study. 20 subjects in each group.

Statistical Analysis: Paired t-test and ANOVA were used to analyze the obtained data.

Results and Conclusion: All three techniques SMI, NDS and static stretch are very effective (p-value<0.0001) in improving hamstring flexibility in subjects with short hamstring syndrome.

KEY WORDS: Short hamstring syndrome, suboccipital muscle inhibition technique, neurodynamic sliding technique, static stretching technique, passive SLR test, active knee extension test, sit and reach test.

Address for correspondence: Miss. Shruti Panchal, 389, In Vanta Area, Bedwa-388320, Anand, Gujarat, India. Mobile. No.: +9175657077395 **E-Mail:** shrutipanchal68@gmail.com

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INTRODUCTION

"Shortness of hamstring muscles is restriction of knee extension when the hip is flexed or restriction of hip flexion when the knee is extended."[1]

Shortening of the hamstring can be examined by the finger-floor distance (FFD) and straight leg raise (SLR) test, and if a person can't touch the floor with his/her fingertips in the bent-forward position or the SLR is lower than 80°, the person is considered to have reduced hamstring extensibility [2].

The length of the hamstring muscles is considered to play an important role in both the

effectiveness and the efficiency of basic human movements, such as walking and running. Clinical observations have suggested that short hamstrings are associated with various problems. Tight hamstring muscles increase the patella-Femoral compressive force because of the increased passive resistance during the swing phase of ambulation and running. On the other hand, short hamstrings resulting from nerve root tension associated with inter-vertebral disc protrusion are probably transmitted reflexively because effective treatment of the protrusion will rapidly correct the problem. However, many healthy people without nerve root tension or other pathological conditions also may present short hamstrings. In Addition hamstrings cross over two joints when tight muscle fails to pass through full physiological amplitude under rapid and stressful situations. This Results in varying degree of muscle damage and ultimately various hamstring injuries [3-5].

Varity of treatment are available for reducing pain, enhancing relaxation such as muscle relaxant drugs. Various physical therapy intervention are there to relive hamstring muscle tightness such as stretching, PNF techniques, MET, local heat application etc..but we are interested in three different technique which are: Sub-occipital muscle inhibition technique, Neurodynamic Sliding Technique and Static Stretching Technique.

Suboccipital muscle inhibition technique: The suboccipital muscle inhibition technique is a method of relaxing the tension in the four muscles located between the occiput and axis, which regulates the upper cervical vertebra (rectus capitis posterior major, rectus capitis posterior minor, obliqus capitis inferior, and obliqus capitis superior); these muscles are known to be associated with regulating body posture as well as rotation of the head. The suboccipital muscles are involved in postural control and this will affect the results of tests involving the straight leg raise test. Release of the muscle fascia allows greater stretching and reduces the tone of the knee flexors owing to the high density of neuromuscular bundles in the sub-occipital muscles. This is because the hamstrings and suboccipital muscles are connected by one neural system, which passes through the dura mater. Myers called this the superficial back line [6,2,3].

Neurodynemic Sliding Technique: Effective-ness and the efficiency of basic human movements, such as walking and running. Clinical observations have suggested that short hamstrings are associated with various problems. Tight hamstring muscles increase the patella-Femoral compressive force because of the increased passive resistance during the swing phase of ambulation and running. On the other hand, short hamstrings resulting from nerve root tension associated with inter-vertebral disc protrusion are probably transmitted reflexively because effective treatment of the protrusion will rapidly correct the problem. However, many healthy people without nerve root tension or other pathological conditions also may present short hamstrings. In Addition hamstrings cross over two joints when tight muscle fails to pass through full physiological amplitude under rapid and stressful situations. This Results in varying degree of muscle damage and ultimately various hamstring injuries [3-5].

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reduces the tone of the knee flexors owing to the high density of neuromuscular bundles in the sub-occipital muscles. This is because the hamstrings and suboccipital muscles ar

Neurodynamics is the term used to describe the integration of the morphology, biomechanics and physiology of the nervous system. An individual with decreased hamstring extensibility may demonstrate limited range in the passive straight leg raise test because of altered neurodynamics affecting the sciatic, tibial and common fibular nerves. Abnormal posterior lower extremity neuro-dynamics may influence resting muscle length and lead to changes in the perception of stretch or pain. Neurodynamics sliding technique can be useful to alter such sensation and ultimately can improve hamstring flexibility. In these exercises tension is increased at one end and lessened at the opposite end of the nerve, thus improving nerve excursion [7].

Static Stretching Technique: Static stretching exercise is a kind of exercise that is done in a static state without any additional movement other than the motion of the muscle stretch. Besides that, static stretches cause the individual at the stretch and hold position for specific amount of time [8]. Benefits of this slower stretching technique include that the stretch prevents the tissue from having to absorb great amounts of energy per unit time, the slow stretch will not elicit a forceful reflex contraction, and this technique alleviates muscle soreness. According to Smith static stretching has the least associated injury risk and is believed to be the safest and most frequent method of stretching [9].

MATERIALS AND METHODS

· **Study design:-** Pre-test post test quasi experimental study design.

· **Study population and setting –** Subjects with age group 18 to 25 year were taken with tight hamstrings that are recreationally active and fulfill the inclusion criteria from Shree B.G.Patel college of physiotherapy, Anand.

· **Inclusion criteria:-**

1. Willingness of the subjects to participate in the study (informed consent signature);

2. all the subjects in age group 18- 25 years;

3. Unilateral or bilateral short hamstring syndrome; SLR test, 80^0 or less and active knee extension 125^0 or less.

· **Exclusion criteria:**

1. History of any injury to lower limb;

2. History of herniated disk or lumbar protrusions;

3. History of acute back pain;

4. History of pain paresthesia in lower limbs.

·**Material:-**

o Plinth

o Scale

o Goniometer

o Step stool

o Wedge

o Pillow

o Stop watch

o Marker

Data collection technique: 80 subjects with age group between 18 to 25 year with short hamstring syndrome were taken from Shree B.G. Patel college of Physiotherapy, Anand. They all divided randomly into four group 20 subjects in each group: SMI group, NDS group, static stretching group and control group. Active knee extension test, passive SLR and Sit and reach test were taken before and after 10 days interventions in all groups.

Outcome Measures:

Active Knee Extension test: The test measures the angle of knee flexion with a pendulum goniometer after active knee extension with the hip stabilized at 90 degrees flexion. The angle of knee flexion represents hamstring tightness. The reliability coefficients for test and retest measurements were .99 for right and left extremity. Kao et al reported that popliteal angle is to be 180^0 from birth to 2yrs of age, which then decreased to about 155^0 by age of 6 yrs and then remained fairly constant after that. If the angle is less than 125^0 the hamstring were considered to be tight [10-12].

Passive Straight Leg Raising Test: The passive straight leg raise test is an additional test used frequently to indicate hamstring muscle length [13]. The validity of the SLR test depends on its

ability to indicate the distance between the origin and insertion of hamstring muscle. Most investigators however, have used goniometric method to measure the angle [14]. If the angle between straight leg and pelvis is less than 80^0 then it is considered to have tight hamstrings [1].

Modified Sit and Reach test: Several sit and reach tests are commonly used in health related and physical fitness test batteries to evaluate the hamstring and lower back flexibility. Sit on the floor with the back and head against a wall with the legs fully extended with the bottom of the feet against the sit-and-reach box. Place the hands on top of each other, stretching the arms forward while keeping the head and back against the wall. Measure the distance from the fingertips to box edge with a yardstick. This becomes the zero or starting point. The total distance reached to the nearest one-tenth inch [15].

Intervantions:

Sub-occipital muscle inhibition technique: The patient is in supine position with eyes closed, the therapist stand behind the subject's head and placed the palms of her hands beneath it, resting the pads of her fingers on the projection of the posterior arch of the atlas. Pressure was exerted upward and toward the therapist. The pressure was maintained for 2 minutes until tissue relaxation had been achieved [2,3,16].

Neurodynamic sliding technique:-Subjects were supine with their neck and thoracic spine supported in a forward flexed position. Concurrent hip and knee flexion were alternated dynamically with concurrent hip and knee extension. The therapist alternated the combination of movement depending on the tissue resistence. This combination of movements was performed for 180 seconds on their dominant lower extremity [17]

Static stretching:- The subject positioned in supine lying on couch therapist elevates the patient's leg to feel a hamstring stretch while maintaining the knee in extension. This stretching was given for thirty seconds with three repetitions bilaterally and 15 seconds rest in between [4,18].

RESULTS

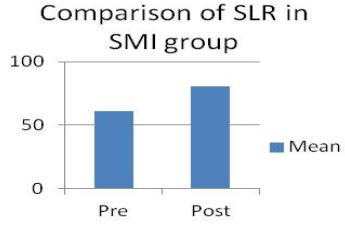
Results would be obtained by comparing pre and post intervention values of outcome measures (SLR, AKE and SRT) by using paired t-test where as between group comparison of post data mean and SD is done by using ANOVA.

Pre-Post comparison of outcome measures:

Table 1: Comparison of SLR in G1.

Comparison of SLR in G1				
	Mean	**SD**	**t value**	**P-value**
Pre	61.05	7.31	11.23	<0.0001
Post	80.75	4.67		

Graph 1: Comparison of SLR in SMI group.

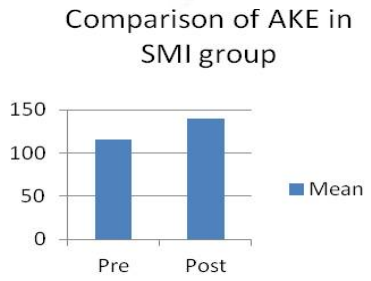


When we compared SLR in group with pre mean value 61.05 with post mean value 80.75 with SD of 7.31 and 4.67; the obtain p-value was <0.0001 which is statistically highly significant.

Table 2: Comparison of AKE in G1.

Comparison of AKE in G1				
	Mean	SD	t value	P-value
Pre	115.1	5.48	19.5	<0.0001
Post	140	4.87		

Graph 2: Comparison of AKE in SMI group

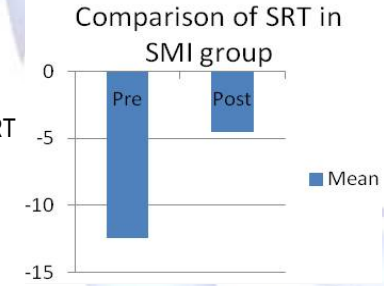


When we compared AKE in group with pre mean value 115.1 with post mean value 140 with SD of 5.48 and 4.87; the obtain p-value was <0.0001 which is statistically highly significant.

Table 3: Comparison of SR in G1.

Comparison of SR in G1				
	Mean	SD	t value	P-value
Pre	-12.4	4.68	10.79	<0.0001
Post	-4.5	5.96		

Graph 3: Comparison of SRT in SMI group.

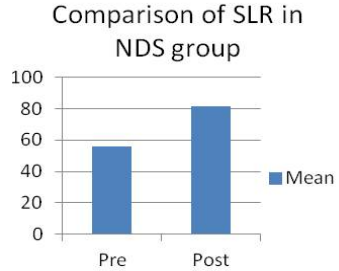


When we compared SR in group with pre mean value -12.4 with post mean value -4.5 with SD of 4.68 and 5.96; the obtain p-value was <0.0001 which is statistically highly significant.

Table 4: Comparison of SLR in G2.

Comparison of SLR in G2				
	Mean	SD	t value	P-value
Pre	55.6	8.36	14.42	<0.0001
Post	81.25	3.19		

Graph 4: Comparison of SLR in NDS group.

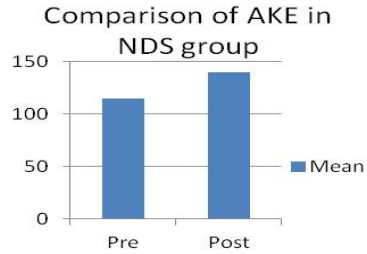


When we compared SLR in group with pre mean value 55.6 with post mean value 81.25 with SD of 8.36 and 3.19; the obtain p-value was <0.0001 which is statistically highly significant.

Table 5: Comparison of AKE in G2.

Comparison of AKE in G2				
	Mean	SD	t value	P-value
Pre	114.4	6.72	14.72	<0.0001
Post	137.2	4.42		

Graph 5: Comparison of AKE in NDS group.

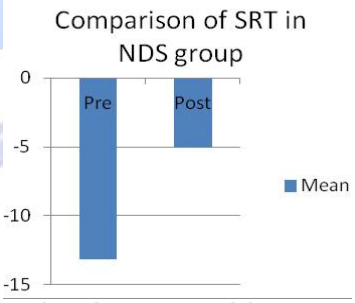


When we compared AKE in group with pre mean value 114.4 with post mean value 137.2 with SD of 6.72 and 4.42; the obtain p-value was <0.0001 which is statistically highly significant.

Table 6: Comparison of SR in G2.

Comparison of SR in G2				
	Mean	SD	t value	P-value
Pre	-13.15	3.57	13.65	<0.0001
Post	-5.05	3.66		

Graph 6: Comparison of SRT in NDS group.

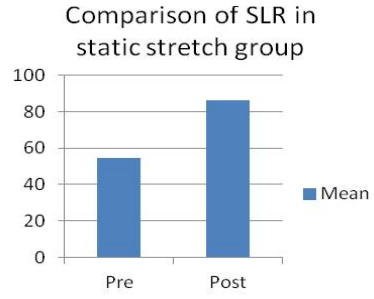


When we compared SR in group with pre mean value -13.15 with post mean value -5.05 with SD of 3.57 and 3.66; the obtain p-value was <0.0001 which is statistically highly significant.

Table 7: Comparison of SLR in G3.

Comparison of SLR in G3				
	Mean	SD	t value	P-value
Pre	54.75	8.81	25	<0.0001
Post	86	4.47		

Graph 7: Comparison of SLR in Static Stretch group.

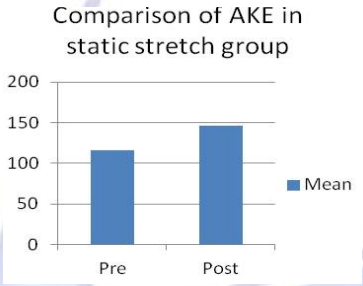


When we compared SLR in group with pre mean value 54.75 with post mean value 86 with SD of 8.81 and 4.47; the obtain p-value was <0.0001 which is statistically highly significant.

Table 8: Comparison of AKE in G3.

Comparison of AKE in G3				
	Mean	**SD**	**t value**	**P-value**
Pre	115.65	3	25.46	<0.0001
Post	146.55	7.64		

Graph 8: Comparison of AKE in Static Stretch group.

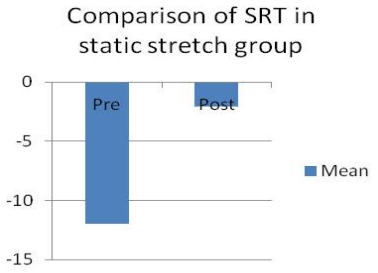


When we compared AKE in group with pre mean value 115.65 with post mean value 146.55 with SD of 3 and 7.64; the obtain p-value was <0.0001 which is statistically highly significant.

Table 9: Comparison of SR in G3.

Comparison of SR in G3				
	Mean	**SD**	**t value**	**P-value**
Pre	-11.95	4.83	45.74	<0.0001
Post	-2.05	4.56		

Graph 9: Comparison of SRT in Static Stretch group

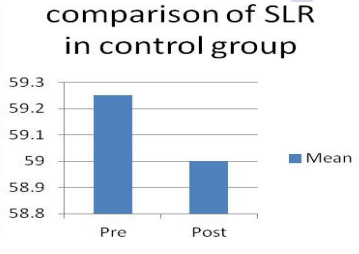


When we compared SR in group with pre mean value -11.95 with post mean value -2.05 with SD of 4.83 and 4.56; the obtain p-value was <0.0001 which is statistically highly significant.

Table 10: Comparison of SLR in G4.

Comparison of SLR in G4				
	Mean	**SD**	**t value**	**P-value**
Pre	59.25	5.32	0.3655	0.7188
Post	59	5.07		

Graph 10: Comparison of SLR in control group.

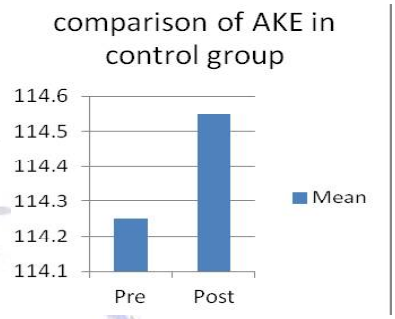


When we compared SLR in group with pre mean value 59.25 with post mean value 59 with SD of 5.32 and 5.07; the obtain p-value was 0.7188 which is statistically not significant.

Table 11: Comparison of AKE in G4.

Comparison of AKE in G4				
	Mean	**SD**	**t value**	**P-value**
Pre	114.25	6.8	0.6158	0.5454
Post	114.55	6.92		

Graph 11: Comparison of AKE in control group.

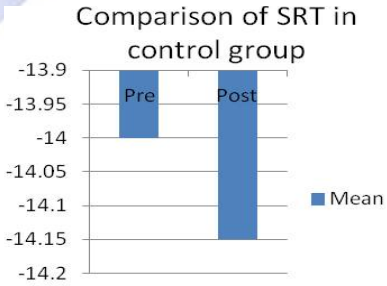


When we compared AKE in group with pre mean value 114.25 with post mean value 114.55 with SD of 6.8 and 6.92; the obtain p-value was 0.5454 which is statistically not significant.

Table 12: Comparison of SR in G4.

Comparison of SR in G4				
	Mean	**SD**	**t value**	**P-value**
Pre	-14	4.21	0.4381	0.6663
Post	-14.15	4.23		

Graph 12: Comparison of SRT in control group.



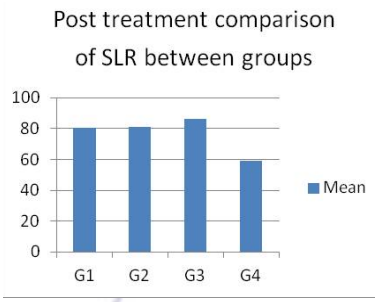
When we compared SR in group with pre mean value -14 with post mean value -14.15 with SD of 4.21 and 4.23; the obtain p-value was 0.6663 which is statistically not significant.

Between group comparison of post data.

Table 13: Post treatment comparison of SLR between group.

Post treatment comparison of SLR between group				
Group	**Mean**	**SD**	**F(ANOVA)**	**p-value**
G1	80.75	4.67	150	<0.0001
G2	81.25	3.19		
G3	86	4.47		
G4	59	5.07		

Graph 13: Post treatment comparison of SLR between groups.

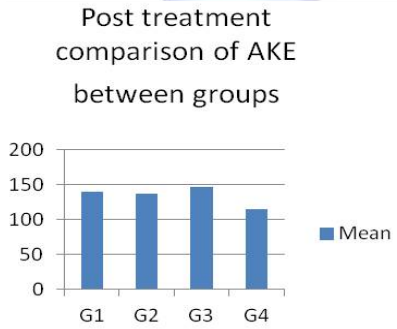


When we compared post AKE values between groups with mean of 80.75, 81.25, 86 and 59 respectively in group 1 to 4; SD is 4.67, 3.19, 4.47, 5.07 in all four groups. Whereas f-value is 150 and p-value is <0.0001 which is highly significant.

Table 14: Post treatment comparison of AKE between group.

Post treatment comparison of AKE between group				
Group	**Mean**	**SD**	**F(ANOVA)**	**p-value**
G1	140	4.87	103.2	<0.0001
G2	137.2	4.42		
G3	146.55	7.64		
G4	114.55	6.92		

Graph 14: Post treatment comparison of AKE between groups.

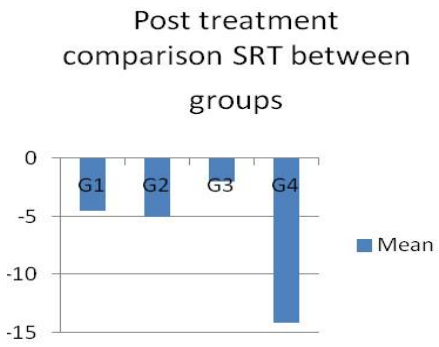


When we compared post AKE values between groups with mean of 140,137.2,146. 55,114.55.1respectively in group 1 to 4;SD is 4.87,4.42,7.64,6.92 in all four groups where as f value is 103.2 and p value is <0.0001 which is highly significant.

Table 15: Post treatment comparison of SR between groups.

Post treatment comparison of SR between group				
Group	**Mean**	**SD**	**F(ANOVA)**	**p-value**
G1	-4.5	5.96	25.68	<0.0001
G2	-5.05	3.66		
G3	-2.05	4.56		
G4	-14.15	4.23		

Graph 15: Post treatment comparison of SRT between groups.



When we compared post SRT values between groups with mean of -4.5, -5.05, -2.05 and -14.15 respectively in group 1 to 4; SD is 5.96, 3.66, 4.56 and 4.23 in all four groups where as f value is 25.68 and p value is <0.0001 which is highly significant.

CONCLUSION

From the results we can see that neuro-dynamic sliding technique has great effect for improving SLR than sub-occipital muscle inhibition technique, static stretching and control group.

Static stretching is more effective in improving active knee extension and sit and reach length than sub-occipital muscle inhibition technique, neuro-dynamic sliding technique and control group.

Sub-occipital muscle inhibition technique is also very effective in all three outcome measures.

Conflicts of interest: **None**

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