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IMMEDIATE EFFECT OF SELF MULLIGAN BENT LEG RAISE MOBILIZATION VERSUS SELF SCIATIC NERVE MOBILIZATION IN SUBJECTS WITH UNILATERAL LUMBAR RADICULOPATHY

Physiotherapy

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ABSTRACT

Background and Objective: Lumbar radiculopathy may be described as pain originating in the lower back region, and radiating into one or both lower limbs. The self neural and mulligan BLR found effectiveness of each in the management of radiculopathy. Therefore, the purpose of the study is to find the immediate effect of self Mulligan Bent Leg Raise mobilization versus self sciatic nerve mobilization on improvement of radiculopathy pain and SLR range in subjects with unilateral lumbar radiculopathy

Method: Pre to post test experimental study design with two groups: MBL Group (Mulligan Bent raise leg) and SNM (Sciatic nerve mobilization) Group. Total 40 subjects (20 were in MBL Group and 20 were in SNM Group) with low back pain accompanied by radiating pain slected based on Simple random sampling method. Intensity of Radiculopathy pain was measured using Visual analogue scale and Straight leg raise was measured using Goniometer before and immediately after the technique application.

Results: Analysis using Mann Whitney U test and Independent 't' between the groups found that that there is no statistically significant difference in pre-test and post test means of VAS and SLR ROM when compared between the groups, where as within the groups analysis found that there is a statistically significant change in means of VAS score and SLR ROM when means were analyzed from pre-test to post-test within the groups.

Conclusion: It is concluded that both self mulligan bent leg raise mobilization and self sciatic nerve mobilization techniques are effective in immediate reduction of pain and improving Straight leg raise ROM in subjects with unilateral lumbar radiculopathy.

KEYWORDS

Unilateral lumbar radiculopathy, self mulligan bent leg raise mobilization, self sciatic nerve mobilization technique, Radiculopathy pain and SLR range of motion, Visual Analogue Scale

INTRODUCTION

Low back pain is neither a disease nor a diagnostic entity of any sort. In India, incidence of low back pain(LBP) has been reported to be 23.09% and has a lifetime prevalence of 60- 85%.[1, 2] Prolapsed intervertebral disc (PIVD) is the most common cause of lumbar radiculopathy.[3]Lumbar radiculopathy may be described as pain originating in the lower back region, and radiating into one or both lower limbs. It usually follows a specific dermatomal distribution, indicating the level of spinal nerve root involvement with sensory symptoms are pain, typically accompanied with paraesthesias, numbness; and sometimes motor symptoms may include muscle weakness, reduced deep tendon jerks[4,5].

Neuromobilization is a set of techniques designed to restore plasticity of the nervous system, it may be defined as the ability of the nerve, its sheath and structures surrounding it to shift in relation to other such structures. The goal of mobilization is to increase the flexibility of collagen that maintains the integrity of the nerve, thereby improving movement of the nerve in relation to its interface[6]. It is also found that mulligan mobilization techniques are effective in improving straight leg raise (SLR) range.[7,8].Mobilization of nervous tissue has been postulated as one of the causes for improvements in SLR test seen post BLR.[9] Nerve mobilization techniques have been recently used as a method to adjust radiating pain related to disk disease, and in particular, mobilization techniques for the sciatic nerves, improve mobility of the sciatic nerves, decrease mechanosensitivity of the nervous system, and heighten compliance of nerve tissues, relieving low back pain. Research on nerve mobilization techniques aimed at treating low back pain in patients with radiating pain has been lacking.[13]As there are studies have found in the literature on effectiveness of neural mobilization and mulligans bent leg raise on low back pain with radiculopathy. There is a need to find the comparative effect of self sciatic nerve mobilization and mulligan BLR technique on lumbar radiculopathy.[14,15]

Neural tissue mobilization targets breaking adhesions in the structures present along the course of the nerve, at the mechanical interface, thereby improving the gliding of the nerve by eliminating the cause of symptom-causing obstruction; while the Mulligan concept involves correcting the positional fault at the spinal level along with performing the offending physiological movement (here, the Straight Leg Raise). The clinical appropriateness and effectiveness of this technique is based on the immediate reduction in pain and increase in mobility.[16] Finding the comparative effect of self mobilization techniques will clinically provide a guiding stone for therapists to patient in the management of radiculopathy, on the usage of self neural and mulligan BLR effectiveness of each as compared to one another and to make evidence based decisions on the proper use of either mode of treatment for the management of radiculopathy. Therefore, the purpose of the study is to find the immediate effect of self Mulligan Bent Leg Raise mobilization versus self sciatic nerve mobilization on improvement of radiculopathy pain and SLR range in subjects with unilateral lumbar radiculopathy.

METHOD

A comparative study design conducted on 20 subjects who were with unilateral lumbar radiculopathy. As this study involved human subjects the Ethical Clearance was obtained from the Ethical Committee. This study was registered under Rajiv Gandhi University of Health Sciences for subject for registration for dissertation with registration number 09_MT154. Subjects included in the study were with low back pain accompanied by radiating pain up to below knee and posterior leg without neurological deficits. Age group between 30 and 50 years, pain indexes with three points or higher in NPRS, Oswestry Disability indexes more than 20%, Straight leg raise test (SLR) results between 30 and 50 degrees. Subjects were excluded with Red flag signs for neural mobilization and mulligan's bent leg raise, those with rheumatism, osteoporosis, any surgical fixation, malignant tumours, radiating pain from spinal lesion other than disc bulge, history of surgery in and around spine and lower limb and problems with peripheral blood vessels.

Subjects who meet inclusion criteria were informed about the study and a written informed consent was taken. Study conducted at multi centre. Subjects were recruited from various hospitals, and clinics in Bangalore were recruited. A single time study, conducted from October 2010 to May 2011.

Procedure:
The subjects whom were selected according to the inclusion criteria and who was able to read and understand English was selected and explained about the purpose of the study. Their personal demographic data was collected at the beginning. Subjects were randomly allocated and assigned to either MBL Group (Mulligan Bent raise leg) or SNM (Sciatic nerve mobilization) Group with 20 subjects in each group respectively, the groups were balanced with finally equal numbers who completed the study.

Procedure of intervention for MBL Group (Self Mulligan Bent raise leg): The subject received self Mulligan's Bent Leg raise technique under supervision. Subject lying in supine position place one hand under his/her knee, perform hip flexion as far as possible keeping knee flexed. The heel was off the bed and then therapist asked the patient to push his back of leg against back of thigh resistance and then relax. At this point subject raise the leg gently as far as he can lift the leg from the bed, with maintaining or increasing knee flexion he/she perform slightly hip abduction at the same time with three repetition of isometric contraction of hamstring and it was held for pain free 7 seconds followed by stretch applied, three repetitions of Mulligan's Bent Leg Raise was done with 7 seconds hold and 5 seconds relax time and procedure was performed in five progressive greater position of hip flexion.[8-15,40]

Procedure of intervention for SNM (Sciatic nerve mobilization) Group:[17,18,19] The subjects received self sciatic nerve mobilization technique under supervision. Firstly, the subject was instructed about the procedure. Subject sat in slump position. Mobilization technique to relax the sciatic nerves was performed by the subject on his/her own under the supervision of the therapist. The first step subject extends the knee joint only to the range of pain. The second step subject extends the knee joint to the range of no pain and to flex the top of the foot within the range of no pain. The third step the subject extends the knee joint to the range of no pain and to flex the top of the foot within the range of no pain and flex the neck. As the steps progressed, the tension of the sciatic nerves heightened, and the neck flexion in the third step was used as a method to induce maximal tone of the nerves. Further progression was made to perform straight leg raise. Subjects perform these mobilization movements for approximately 60 seconds and repeated them 5 times. At present, there is no research evidence on the appropriate dosage for active neurodynamic sliders. However, we chosed 60 s and 5 repetitions.[24]

Outcome Measurements
Intensity of Radiculopathy pain was measured using Visual analogue scale and Straight leg raise was measured using Goniometer before and immediately after the technique application.

Intensity of Radiculopathy pain was measured by Visual Analogue Scale: Pain intensity was assessed using a visual analogue scale (VAS). Subject place a horizontal mark on a continuous 10 cm line to indicate pain intensity, ranging from no pain or discomfort to the worst pain they could possibly feel. The reliability and validity of VAS has been established previously.

Straight leg raises (SLR) Range of motion: Subject was positioned supine on the plinth, and the lower extremity not being measured was secured to the table with a Mulligan's belt across the thigh. Another Mulligan's belt was placed over the anterior superior spines of the iliac to stabilize the pelvis. The passive SLR test was used to determine changes in neural length. With the subject in the supine position, the lateral condyle of the femur, the head of the fibula and the fibular malleolus was pinpointed. The axis of a goniometer was placed on the projection of the greater trochanter of the femur. One of the arms of the goniometer was placed parallel to the table (checking with a level). The knee and ankle was kept in the extension position. Another therapist, holding the talus and without rotating the hip, flexion of the hip was be gradually lifting the subjects' lower limb until they first complained of pain in the region of the posterior thigh. The point of first onset of pain has traditionally been referred to as P1.[6] Care was taken to ensure that subject not bend their knee, or begin to swing the pelvis in retroversion. At that moment, the other arm of the goniometer was placed in the direction of the line between the head of the fibula and the fibular malleolus, and the degree of elevation of the straight leg was noted. One therapist was performing the passive SLR to P1, while the other therapist was taking the goniometric measurement.[6]This measurement has been shown to have high reliability and validity in various studies. Measurements were taken before the intervention and re-evaluated after the intervention.[6,44-49.]

Statistical Methods:
Descriptive statistical analysis has been carried out and presented as mean SD. Significance was assessed at 5 % level of significance with p value 0.05 less than this is considered as statistically significant difference. Paired 't' test as a parametric and Wilcoxon signed rank test as a non-parametric test have been used to analysis the variables pre-intervention to post-intervention. Independent 't' test as a parametric and Mann Whitney U test as a non-parametric test have been used to compare the means of variables between groups. The Statistical software SPSS 17.0 was used for the analysis of the data.

RESULTS:
The basic characteristics of subjects studied were presented in Table-1. The table-2 shows that there is a statistically significant change in means of VAS score and SLR ROM when means were analyzed from pre-test to post-test within the groups with positive percentage of change showing that there is increase in post means and negative percentage of change showing there is decrease in post means.

The table-3 shows that there is no statistically significant difference in pre-test and post test means of VAS and SLR ROM when compared between the groups.

Table 1: Basic Characteristics of the subjects studied

Basic Characteristics of the subjects d studied		MBL Group	SNM Group	Between the groups Significance
Number of subjects studied (n)		20	20	- -
Age in years (Mean± SD)	33.65± 7.08 (25-48)	34.90± 11.14 (22-54)	p= 0.924 (NS)	
Gender	Males	7	7	
	Females	13	13	
Side	Right	10	10	--
	Left	10	10	

Table 2: Analysis of SLR ROM within MBLR and SNM Groups (Pre to post test analysis)

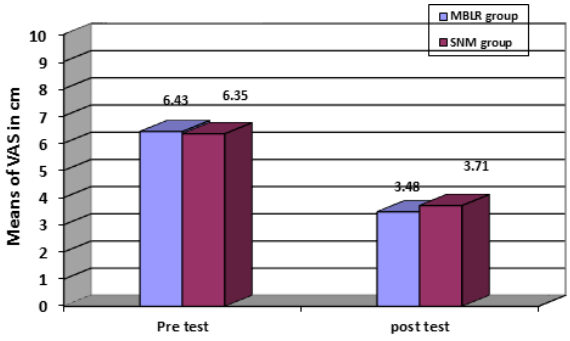
	Pre-test (Mean±SD) min-max	Post-test (Mean±SD) min-max	Z value[a] (Non parametric) [a]	t value[b] (parametric) [b]	Parametric Significance P value[b]	Percentage of change	95%Confidence interval of the difference	
							Lower	Upper
			MBLR Group					
VAS	6.43 ± 1.30 (4.38- 8.7)	3.48 ± 1.89 (0.0 -6.5)	-3.921 p=0.000 **	8.703	p=0.000 **	-45.87%	2.2443	3.6657
SLR ROM	56.65 ± 7.84 (42- 70)	69.05 ± 8.30 (50 -82)	-3.925 p=0.000 **	-17.499	p=0.000 **	21.88%	-13.883	-10.917
			SNM Group					
VAS	6.35 ±1.18 (4.5 – 8.1)	3.71 ±1.67 (1.0 – 7.3)	-3.784 p=0.000 **	6.515	p=0.000 **	-41.57%	1.7884	3.4816
SLR ROM	52.20 ± 9.26 (36- 70)	61.50 ± 9.79 (44 -80)	-3.930 p=0.000 **	-17.115	p=0.000 **	17.81%	-10.437	-8.163

** Statistically Significant difference p<0.05; NS- Not significant; a. Wilcoxon Signed Ranks Test. b. Paried t test.

Table 3: Comparison of means of SLR ROM between MBLR and SNM Groups

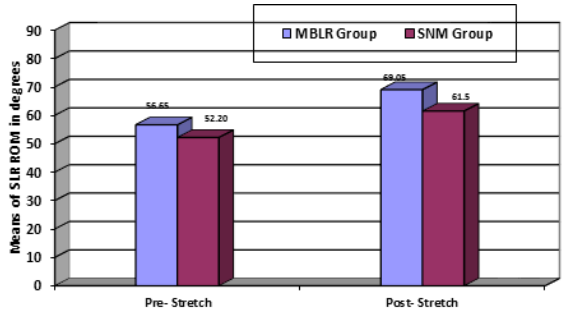
	MBLR Group	SNM Group	Percentage of difference	Z value[a] (Non Parametric)	t valueb (Parametric)[b]	Significance (1-tailed) P value[b]	95%Confidence interval of the difference	
							Lower	Upper
PRE-VAS	6.43 ± 1.30 (4.38- 8.7)	6.35 ±1.18 (4.5 - 8.1)	-1.25%	-0.149 P=0.882	0.215	p=0.831 (NS)	-0.7141	0.8841
PRE-SLR ROM	56.65 ± 7.84 (42- 70)	52.20 ± 9.26 (36- 70)	-8.17%	-1.576 P=0.115	-0.416	p=0.110 (NS)	-1.047	9.947
POST-VAS	3.48 ± 1.89 (0.0 -6.5)	3.71 ±1.67 (1.0 - 7.3)	6.40	-0.014 P=0.989	-0.416	p=0.680 (NS)	-1.3798	0.9098
POST-SLR ROM	69.05 ± 8.30 (50 -82)	61.50 ± 9.79 (44 -80)	-11.56%	-2.344 P=0.019	2.630	p=0.012 (NS)	1.738	13.362

Graph- 1: Analysis of VAS between MBLR and SNM Groups



The graph-1 shows that there is no statistically significant difference in pre-test to post-test means of VAS score when compared between the groups.

Graph- 2: Comparison of means of Score of SLR between MBLR and SNM group



The graph-2 shows that there is no statistically significant difference in pre- test and post-test SLR ROM means when compared between the groups.

DISCUSSION

In this study finding from the analysis found that there is no statistically and clinically significant difference in immediate effect between SNM group, who received self sciatic nerve mobilization technique and MBLR group, who received self Mulligan bent leg raise technique on increasing hamstring flexibility. However there is a significant difference in improvement within the group.

In SNM group, who received self Neurodynamic sliding technique showed that there is a statistically significant change in means of VAS score and passive SLR ROM, when means were analysed from pre intervention to post intervention measurements within the group with positive percentage of change showing there is increase in post means. This could be due to self neurodynamics sliding technique, when tension is applied to the nervous system while applying neurodynamics, it causes reduction in cross-sectional area and increase in pressure in the nerve that results in extension and movement of the sciatic nerve together with the hamstring and this compliance of the nerve, results in increased flexibility. When applying neurodynamics, tension that occurs in the nervous system and pressure within the nerve increases due to the decrease of the cross-sectional area, and the axonal transport system lengthens the sciatic nerve after shortening because of the influence of the surrounding related structures and hamstring flexibility.[24]

The observed changes may have been secondary to decreasing neuromeningeal sensitivity or may be that the neurodynamic sliders led to a modification of sensation such that the individual's perceptions of stretch or pain were altered.[6] Such a proposal is further supported by a recent study conducted by Aparicio, Quirante et.al.in 2009. Theauthors examined the immediate effect of a suboccipital muscle inhibition (SMI) technique on hamstring flexibility (measured by the forward flexion distance test; straight leg raise test; and popliteal angle test) and pressure pain threshold (PPT) over myofascialtrigger points (MTrPs) in the hamstring musculature. Seventy subjects comprised of 49 students from the Physiotherapy School of the University of Extremadura (Spain) and 21 soccer players from the Extremadura Football Club, were randomly assigned to receive SMI or a placebo intervention. Results demonstrated that the SMI technique modified the flexibility of the hamstring muscles on all outcome measures, and furthermore, there was a significant difference in pressure algometry (PPT) for MTrPs in the right semimembranosus following the SMI (p ¼ .021) but not the left semimembranosus (p ¼ .079). The fact that such a distant technique (suboccipital region) can have an immediate effect on the flexibility and pressure pain thresholds in thehamstrings may lend support to the 'sensory theory' proposed by Weppler and Magnusson (2010). It appears reasonable to suggest that the observed increases in hamstring tissue extensibility following the SMI would have more likely come from changes in the subjects' perceptions of stretch or pain associated with the flexibility and pressure pain testing.[6,10,25] Although our study does not provide information about the mechanism of action or change, it does suggest that neurodynamics treatment can significantly increase hamstring flexibility in asymptomatic individuals.

In MBLR group, who received self Mulligan bent leg raise technique showed that there is a statistically significant change in means of Vas score and passive SLR ROM, when means were analyzed from pre intervention to post intervention measurements within the group with positive percentage of change showing there is increase in post means. Mulligan's BLR technique utilizes passive flexion at the hip which 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.[26, 27.] With hip flexion during BLR, there is obligatory lumbar flexion. With lumbar flexion, the lateral intervertebral foramina and central canal open further facilitating caudal movement of the neural structures. This movement of neural structures could be effective in dispersing intraneuraledema, thus restoring pressure gradients and relieving hypoxia. Improved mechanics of the neural structures would be one mechanism for improvements noted post BLR. BLR also involves isometric contraction of hip extensors followed by stretch of the same muscles also referred to as 'Post Isometric Relaxation'. Post-isometric relaxation refers to the assumed effect of reduced tone experienced by a muscle or a group of muscles after brief periods following an isometric contraction. Improvements noted in 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.

Another explanation could be that decrease in pain- VAS and increase in passive SLR ROM with MBLR technique is due to changes in pain responsiveness. The explanations for changes in pain responsiveness have not been well understood. Afferent input from muscles and joints during BLR, may interfere with signals from nociceptive fibers (stretch discomfort), subsequently inhibiting an individual's perception of pain. This explanation is consistent with the gate control theory of pain.[32.] Mulligan's Mobilization with Movement (MWM) is

reported to cause pain relief through neurophysiological effects like sympathoexcitation, improvements in motor function and non-opioid hypoalgesia in patients with lateral epicondylalgia. Whether Mulligan's BLR can have similar neurophysiological effects needs to be further evaluated. Alternatively, changes in pain responsiveness may be psychologically mediated. It is possible that participants anticipated the positive effects of BLR, so their perception of pain during passive SLR was dampened. According to the gate control theory, sensations of pain and discomfort are affected by descending modulatory influences from higher centers. Prior motivation, elevated mood and confidence from positive expectations of BLR are all potential psychological contributors explaining the participants' altered perception of discomfort and willingness to tolerate greater stretch over time.[4, 33.] Harvey et al. (2003) found no increase in hamstring extensibility after 4 weeks of hamstring muscle stretching in patients with spinal cord injuries. It seems reasonable to extrapolate that increase in hamstring extensibility is closely connected to central neurophysiological processing, which is severely impaired in patients with spinal cord injuries. Thus it might be assumed that the BLR technique triggers neurophysiological responses influencing the muscle stretch tolerance.

This study found that the small effect size with wider range 95% CI between the groups showing no difference between the groups. One reason for no significant difference in VAS and SLR ROM with SNM and MBLR could be that both the technique targets neural tissue mobility/neurodynamics, which is a method to treat "perceived hamstring tightness". Now with an understanding that subjects with "perceived hamstrings" tightness are more likely to be experiencing altered neurodynamics and respond better to exercises targeting neural tissue mobility.

Hence based on the analysis and findings, the present study found that self sciatic nerve mobilization and Mulligan bent leg raise technique found statistically no significant difference in immediate decrease in pain and passive SLR ROM in asymptomatic individuals. Therefore the study accepts null hypothesis.

Limitations of this study

Subjects with 18-40 years of age were considered for study thus results cannot be generalized to all age group. No follow-up was done after intervention that would have helped to find the maintenance of the improved outcome measures. It is difficult to determine the long term effect of NDST and MBLR because only the immediate effects were observed.

Recommendation for further future study:

Further study need to be studied on long term effect of both techniques for lumbar radiculopathy. Study needed to compare these techniques with other techniques for radiculopathy. The effect of these techniques need to be find out using other outcome measurements and individual with limited hamstring flexibility. The similar techniques for upper limb radiculopathy need to be studied.

Conclusion

It is concluded that both self mulligan bent leg raise mobilization and self sciatic nerve mobilization techniques are effective in immediate reduction of pain and improving Straight leg raise ROM in subjects with unilateral lumbar radiculopathy. However there is no significant difference in improvement between the groups. It is recommended clinically that to use NDST and MBLR techniques for subjects with unilateral lumbar radiculopathy.

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Conflicts of interest: None

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