Effect of Mulligan Bent Leg Raise Technique on Low Back Pain Subjects with Radiculopathy

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Abstract

Brain Mulligan pioneered the use of manual therapy techniques. In clinical practise, these approaches are often utilised. Among many techniques, bent leg raise is an innovative technique that is said to improve the range of straight leg raise, reduce pain, and reduce the degree of impairment in low back pain with radiculopathy. Clinical trial has not sufficiently demonstrated the efficacy of this approach. As a result, research on the effectiveness of the bent leg raise approach in low back pain with radiculopathy on pain and range of motion is required. 30 male subjects with straight leg raise limitations ranging from 30^0 to 70^0 were divided into two groups of 15 each (A and B). Mulligan bent leg raise technique, interferential therapy, intermittent pelvic traction, and spinal extension exercise were administered to Group A. Interferential therapy, intermittent pelvic traction, and spinal extension exercise were administered to Group B for 5 days. The pain and range of straight leg raise were assessed before and after treatment using the Numerical pain rating scale and a universal goniometer, respectively. In Group A, there was statistically significant reduction in NPRS score and improvement in SLR range and the calculated (t=29.078, P value=0.001), (t=22.149, P=0.001). In Group B, there was statistically significant reduction in NPRS score and improvement in SLR range and the calculated (t=20.917, P value=0.001), (t=9.287, P=0.001). When comparing Group, A and B, there was statistically significant reduction in NPRS score and improvement in SLR range was observed in group A. The study concludes that Mulligan bent leg raise is effective in reducing pain and improvement in range of straight leg raise in low back pain subjects with radiculopathy.

Keywords: *Mulligan bent leg raise, Low back ache, Straight leg raise.*

Introduction

Low back pain was once known as an ancient curse is now known as a modern international epidemic.[1] Low back pain is a problem worldwide with a lifetime prevalence reported to be as high as 84% by WHO.[2] In India the lifetime prevalence of Low back pain is 60-85%. It occurs in similar proportions in all cultures, interferes with quality of life and work performance, and is most common reason for medical consultations.[3]

Low back pain is common cause of disability and work loss, yet despite the availability of numerous clinical guidelines on low back pain produced worldwide, there is still a lack of consensus about its most effective management. Physiotherapy interventions for the management of low back pain are wide and variable, but the efficacy of many is still questionable.[4] Despite numerous randomized control trails there is still no strong evidence for efficacious and cost-effective treatment for this disabling condition.[5]

Brain Mulligan developed a most ingenious, pioneering compilation of Manual therapies. Unlike the other mobilization procedures, Mulligan performed while patients were moving, either actively or passively, or while they were performing a resisted muscle contraction. This technique is performed in symptom free range of motion, a factor that probably makes it, safer than many other Manual therapy approaches.[1]

Mulligan has described Mulligan bent leg raise technique which is said to improve range of straight leg raise in low back pain with referred leg pain.[1]It has been suggested that improving straight leg raise mobility reduces the degree of impairment in low back pain.[2]

Mulligan bent leg raise is a painless technique, when indicated, can be tried on patients with low back pain who has limited or painful straight leg raise. The intention of this technique is to restore normal mobility and reduce low back pain and physical impairment.[2]

In spite of its popularity, the efficacy of the Mulligan concept has not been adequately established by clinical trials.[2]There is paucity in the peer reviewed literatures that have seen the effectiveness of Mulligan bent leg raise. Hence, the purpose is to study the effectiveness of Mulligan bent leg raise technique in low back pain with radiculopathy.

Materials and Methods

The present study was an interventional study conducted in the outpatient Department of Physical Medicine and Rehabilitation (PMR), RMMCH, Annamalai University, Tamil Nadu, India, during September, October and November 2019. The study was approved by the Departmental Research Committee (PMR/DRC-10/2019).

During the stipulated period, the sample size was selected using a Randomized sampling method. Thirty patients with Low back ache with radiculopathy (SLR 30º - 70º) were selected. The criteria for the inclusion in the study were (1) Gender: Male; (2) Low back ache with radiculopathy (SLR 30º - 70º); (3) Unilateral involvement. The main exclusion criteria were (1) Subjects with continuous bed traction for low back pain; (2) Subjects with acute Intervertebral disc prolapse (less than 3 weeks); (3) History of any musculoskeletal problems in hip and knee; (4) History of spinal surgery, space occupying lesion, any spine infection.

Study Procedure

Thirty subjects diagnosed as low back pain with radiculopathy (SLR 30º - 70º) were taken for the study. They were randomly assigned in to two groups (A and B) with 15 each. Group A (Experimental group, n=15) receives Mulligan bent leg raise technique along with interferential therapy, intermittent pelvic traction and spinal extension exercise. Group B (control group, n=15) receives interferential therapy, intermittent pelvic traction and spinal extension exercise for 5 days. Pre and Post treatment score for pain and range of straight leg raise using numerical pain rating scale and universal goniometer were assessed respectively.

Outcome Measures

Numerical Pain Rating Scale: The NPRS is a subjective measure that allows individuals to evaluate their pain at an eleven-point numerical scale. The scale ranges of 0 (no pain at all) to 10 (worst possible pain). Patients were asked to mark a line point referring to their perceived quantity of pain during the evaluation[6-9].

Straight leg raise (SLR) test: The test was used to measure the range of straight leg raise. The subject is positioned in supine lying without a pillow under his head, the hip medially rotated and adducted, and the knee extended. The clinician lifts the patient's leg by the posterior ankle while keeping the knee in a fully extended position. The clinician continuous to lift the patient's leg by flexing at the hip until the patient complains of pain or tightness in the back of the leg. Simultaneously goniometer was used to record the range, as axis in greater trochanter, stable arm placed over the midline of the lateral aspect of lower trunk and movable arm placed over the midline of the lateral aspect of the thigh. [10-15]

Interpretation:<30º- might indicate acute spondylolisthesis, gluteal abscess, disc protrusion or extrusion, tumor of the buttock, acute dural inflammation. 30º-70º - might suggest lumbar disc herniation at the L4-S1 nerve roots. >70º- might indicate tightness of hamstring, gluteus maximus, or hip capsule, or pathology of the hip or sacroiliac joints.

Treatment Procedure

Dosimetry of Interferential Therapy [16-18]

Pad placement: Two electrodes over the lumbo sacral roots and two over the lower limit of pain. If pain extends to the foot, the electrodes are placed on the sole and the dorsum. If pain extends to the calf, the electrodes are placed on either side of the ankle. If it is referred to the ischial tuberosities, the electrodes are placed on either side of thigh. Beat frequency: 90-130Hz; Quadripolar method; 15 minutes duration.

Dosimetry of Traction[19&20]

Intermittent pelvic traction with 15 minutes duration (60 sec hold time, 20 sec rest time and 25% of body weight).

Spinal Extension Exercise (Mckenzie Exercise) [21]

Exercises were taught to the patient as home program and to do twice a day with 10 seconds hold and for 30 repetitions.

1. Prone lying – brief periods of prone lying for relaxation of the back muscles.
2. Prone lying-in extension with forearm and elbow support. In this position, the elbows are placed in line with the shoulder joints. Trunk is raised in extension by leaning on the forearm and curling of shoulders and upper back.
3. Prone lying extension on hand support. In this position hands are placed in line with the shoulder joints and trunk is gradually extended by leaning on the hands.
4. Standing - extension. Standing upright, keep hands over the back. Bend trunk as much as possible.

Bent Leg Raise Technique[22&23]

Patient position: Supine lying at the edge of the plinth. Hip and knee in flexion (90º) and subject place the hand of affected side under head and neck. Therapist position: Walk stance, lateral to affected side. Hand placement: Shoulder of the inner hand is placed under the popliteal fossa. Therapist grasps the lower end of thigh with both hands. Mobilization: Longitudinal traction is applied along the long axis of femur. Therapist takes the hip into flexion (towards same side shoulder) until first resistance is felt. Contract and relax is applied by asking the patient to push the therapist's shoulder gently and hold for 5 seconds. Now the therapist takes the patients's hip into further flexion, if pain free, Hold the end position for about 20 seconds, repeat the process three times. Precautions: Knee flexion must be maintained throughout the mobilization. No fixation/stabilization of other leg is required.


Figure: 1& 2 Bend leg Raise Technique

Data Analysis and Results

In the present experiment, the effectiveness of Mulligan bent leg raise technique, NPRS score and Range of SLR were statistically analyzed. The statistical analysis is carried out by **Mann-Whitney test** for comparing age between groups, **Chi Square test for** comparing side of involvement and **Paired sample t-test** for comparing Pre and Posttest measure for pain (NPRS) and Range of SLR within group and between groups**.**

Table-1. Shows pre and posttest mean NPRS score for Experimental group

	Number of subjects (n)	Mean and standard deviation	't' Value	'P' Value
Pre test	15	8.60±1.12	29.078	0.001
Post test	15	1.20±0.41		

Above table shows the NPRS mean Pretest score for 15 subjects was 8.60, while mean Post test score was 1.20. The calculated t-value (29.078), P value <0.001 which is significant at 0.01 level, confirms that there is a significant decrease in NPRS score after treatment.

Table-2. Shows pre and post test mean SLR range for Experimental group

	Number of subjects (n)	Mean and standard deviation	't' Value	'P' Value
Pre test	15	44.27±6.24	22.149	0.001
Post test	15	81.27±2.91		

Above table shows the Pre test mean SLR range for 15 subjects was 44.27, while mean Post test mean SLR range was 81.27. The calculated t-value (22.149), P value <0.001 which is significant at 0.01 level, confirms that there is a significant improvement in mean SLR range after treatment.

Table-3. Shows pre and post test mean NPRS score for Control group

	Number of subjects (n)	Mean and standard deviation	't' Value	'P' Value
Pre test	15	8.60±0.74	20.917	0.001
Post test	15	3.60±0.83		

Above table shows the NPRS mean Pre test score for 15 subjects was 8.60, while the mean Post test score was 3.60. The results were analyzed using t-test and were found to be significant (t=20.917, P<0.001). The results suggest that there is a significant reduction in NPRS score after treatment.

Table 4. Shows pre and post test mean SLR range for Control group

	Number of subjects (n)	Mean and standard deviation	't' Value	'P' Value
Pre test	15	46.20±8.20	9.287	0.001
Post test	15	69.20±6.93		

Above table shows the Pre test mean SLR range for 15 subjects was 46.20, while the Post test mean SLR range was 69.20. The results were analyzed using t-test and were found to be significant (t=9.287, P<0.001). The result confirms that there is a significant improvement in SLR range after treatment.

Table 5. Shows comparison between control and experimental group NPRS mean score

Group	Number of subjects (n)	Mean difference and standard deviation	't' Value	'P' Value
Experimental	15	7.40±0.99	6.393	0.001
Control	15	5.00±0.93		

Above table shows, NPRS mean difference for experimental and control group was 7.40, 5.00 respectively. The mean difference of experimental group is higher than the control group. The calculated t value (6.393), P value <0.001 which is significant at 0.01 level. The result suggests that there is a significant reduction in pain in experimental group than control group.

Table 6. Shows comparison between experimental and control group mean SLR range

Group	Number of subjects (n)	Mean difference and standard deviation	't' Value	'P' Value
Experimental	15	23.00±9.59	4.761	0.001
Control	15	37.00±6.47		

Above table shows, NPRS mean difference for experimental and control group was 23.00,37.00 respectively. The mean difference of experimental group is higher than the control group. The calculated t value (4.761), P value <0.001 which is significant at 0.01 level. The result suggests that there is a significant improvement in SLR range in experimental group than control group.

Discussion

The present study was conducted to evaluate the effectiveness of Mulligan bent leg raise technique in 30 low back pain subjects with radiculopathy with limitation of straight leg raise 30º - 70º, for a period of 3 months. They were randomly assigned into two groups. Group A (n=15) received Mulligan bent leg raise technique, interferential therapy, intermittent pelvic traction and spinal extension exercise and Group B (n=15) received interferential therapy, intermittent pelvic traction and spinal extension exercise. Range of straight leg raise and NPRS were taken as outcome measure.

The results of the experiment indicate there is significant reduction in pain and improvement in range of SLR in experimental group.The result of this study is in accord with other similar studies.[1-5, 24-29] All these studies results are comparative study with other similar technique. Though results are in concordance, there were differences in their theoretical reasoning about the effects of the BLR technique.

In this study the possible explanation for improvement in range of straight leg raise and pain may be due to stretching of the gluteus maximus and adductor magnus part of hamstring which helps in breaking the adhesion between these muscle and sciatic nerve and hence by nerve mobilization in relation to muscle without getting stretched.[22, 30]

But according to Deepak Ragav longitudinal traction reduces pain by stimulating large afferent fibers of muscles and joints that presynaptically inhibit pain fiber transmission at the spinal cord level and also reduce muscle spasm thereby reduce pain and lengthen the tightened muscles.[27]

Brain Mulligan himself advocated the technique is like contract relax method for stretching hamstring to improve flexibility by contract relax cycles that provide peripheral somatic input by the way of contracting muscles and cutaneous contact of the therapist. Changes in alpha and gamma motor neuron activity (influencing hamstring muscle) at a segmental level are likely following this technique that are similar to those effects observed following the implementation of PNF technique.[1, 31]

However, Goeken and Hof (1994) demonstrated that the increased range of straight leg raise, following stretching is mediated via an increase in hip flexion, pelvic rotation, range of SLR and hamstring length, and not related to increased hamstring viscoelastic properties.[24, 27]

As stated by Hutton, mechanism for this augmented joint range of motion is a change in the tissue properties of the muscle. The aim of stretching is to inhibit, the reflex activity reduces resistance and thereby improves joint range of motion.[27,32] Schnek and Mac Diamid (1997) reported repetitive light muscle contractions increase venous, lymphatic drainage and relieve paraspinal congestion.[27]

Interestingly Harvey et al, (2003) found no increase in hamstring extensibility after 4 weeks of hamstring muscle stretching in patients with spinal cord injury. It seems reasonable to extrapolate that increase in hamstring extensibility is closely connected to central neurophysiologic processing, which is severely impaired in patients with spinal cord injury.[2, 33] Thus it might be assumed that the Mulligan bent leg raise technique triggers neurophysiologic responses influencing the muscle stretch tolerance. An increase in hamstring extensibility might reduce stress on painful lumbar tissues and hence allowed an increase in range of SLR.[2]

This study result is not concordance with Oves Patni 2013, the possible explanation, could be the study was conducted on young adults with asymptomatic bilateral hamstring tightness.[8] Whereas Mulligan bent leg raise technique had significant improvement on subjects with low back pain with radiculopathy (Ganjendrakumar Patel, 2014).[1, 2,24,27 & 28] This may be due to the mobilization of the painful, sensitized nerve tissues, similar to the 'slider' effects described by Butler (1991) and Elvey and Hall (1997).[2, 24] From this study it is evident that bent leg raise technique is clinically significant in reducing pain and improvement in range of straight leg raise in low back pain subjects with radiculopathy. However cautious approach is imperative in discriminating acuity and severity of the lumbar disk herniation subjects while prescribing Mulligan bent leg raise technique.

Limitation and Recommendation of the study:

In this study only male subjects were studied so; further studies could be done taking up females.

Age criteria were not set for the sake of sample population. Though there is no statistically significant difference in age between groups, future studies could be done to eliminate the age impact on result.

Uniform baseline range of SLR was not considered within and between groups. Future studies are warranted for uniform or narrow baseline values of range of SLR for selecting samples.

Future study can be done on large sample size.

Effects of BLR and conventional hamstring stretching on low back pain subjects with radiculopathy can be studied to document the pros and cons of the technique and outcome measure difference.

Conclusion

The study concludes that Mulligan bent leg raise is effective in reducing pain and improvement in range of straight leg raise in low back pain subjects with radiculopathy.

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