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THE EFFECT OF MULLIGAN'S BENT LEG RAISE [BLR] VERSUS INSTRUMENT ASSISTED SOFT TISSUE MOBILIZATION [M2T] IN SUBJECTS WITH HAMSTRING TIGHTNESS IN NON - SPECIFIC LOW BACKACHE: A RANDOMIZED CLINICAL TRIAL

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ABSTRACT

Background: Nonspecific low backache is a pain, muscle tension, or stiffness localized between the costal margin and inferior gluteal folds, without sciatica. Only 10% of the cases have a specific cause. One of the risk factors is poor hamstring flexibility. Mulligan's BLR and IASTM have shown to improve hamstring flexibility. No studies have compared both. Therefore the study was undertaken.

Methods: 48 subjects, mean age 34.27 ± 5.30 were recruited. Group A (24 - 15 male and 9 female) received TENS, Mulligan's BLR and conventional exercises. Group B (24 - 12 male and 12 female) received TENS, M2T for Hamstrings and conventional exercises. Outcome measures were taken pre-treatment session 1 and post-treatment session 6.

Results: Pre and post mean the difference in group A [BLR] was 5.96 ± 0.95 for NPRS, 19.38 ±7.28 for Right AKET, 20.54 ± 6.78 for Left AKET, 2.07 ± 6.49 for Lumbar lordosis and 28.38 ± 9.73 for QBPDS. Pre and post mean the difference in group B [M2T] was 5.71 ± 1.20 for NPRS, 17.00 ± 6.94 for Right AKET, 15.75 ± 6.50 for Left AKET, 1.20 ± 4.76 for Lumbar lordosis and 26.42 ± 11.38 for QBPDS. The intragroup comparison was statistically significant, $p = 0.0001$ for all outcome measures. Intergroup comparison was statistically significant, $p < 0.05$ for Left AKET ($p=0.0161$).

Conclusion: Interventions given were equally effective in reducing pain, improving hamstring flexibility, and reducing disability within the group but not between the groups except left AKET.

Keywords: Mulligan's BLR, M2T, lumbar lordosis, hamstring tightness, nonspecific low backache.

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INTRODUCTION

Non - specific low back pain is defined as pain localized between 12th thoracic vertebrae and inferior gluteal folds, without leg pain. Most of the cases have no reason for the pain, i.e., non-specific low backache. Only 10% of the cases have a specific cause. Low backache has a lifetime prevalence of 60 % - 85 %. At any given point of time, about 15 % of adults have low backache [1]. Non – specific low back ache's most important symptoms are pain and disability [2].Epidemiology of low back pain estimates that the first episode of low back pain ranges between 1.5 % and 36 %. Remission of low backache in the first year ranges from 54 % to 90 %. The incidence of low backache is highest in the third decade, and prevalence increases to 60 - 65 and gradually decreases [3].

Based on the etiology, LBP is classified as Specific and Non-specific LBP. 90% of LBP patients are attributed to Non-specific causes [4].The risk factors for Non-Specific Low Back Pain are poor hamstring flexibility. In a study done by Radwan. A et al., they found out that there was a possible relation between mild mechanical LBA and hamstring tightness [5]. Mulligan's Manual Therapy treatment is one of the schools of manual therapy that are frequently used in clinical practice.

Mulligan's bent leg raise (BLR) is a technique used for improving range of straight leg raise (SLR) in subjects with LBP and/or referred thigh pain (Mulligan, 1999) and to increase the flexibility of hamstring. Its effect was studied by Hall T et al. (2006), in subjects with LBA. But it was an immediate effect after a single intervention [6].Instrument Assisted Soft Tissue Mobilization (IASTM) is a soft-tissue treatment technique where a tool is used to stimulate and mobilize the affected scar tissue and myofascial adhesions [7]. Nicole MacDonald et al. (2016) conducted a study to know the effects of IASTM (Tecnica Gavilan, Tracy, CA) on lower extremity muscle performance of the quadriceps muscle. But it was on quadriceps [8].

The study aimed to compare the effect of Mulligan's Bent leg Raise [BLR] and M2T on Hamstring muscle tightness. The hypothesis is that there can be the difference between Mulligan's BLR and M2T in terms of lumbar lordosis using flexicurve, Numeric pain rating scale, Active Knee Extension test, and Quebec Back Pain Disability scale in non-specific low backache subjects.

METHODOLOGY

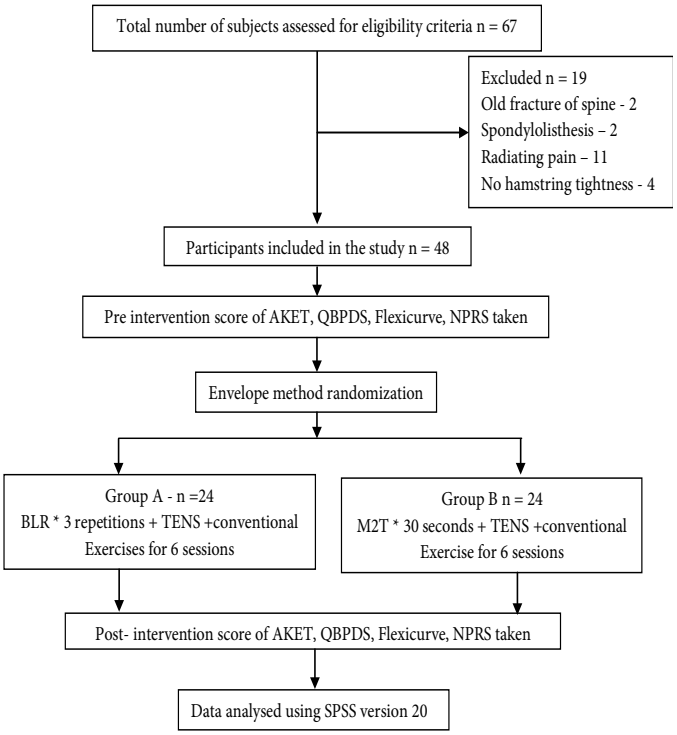


Chart 1: Consort

Approval was obtained from the Institutional Ethical Committee. Sixty-sevensubjects were screened for their inclusion, and exclusion criteria.19 were excluded as they did not meet the inclusion criteria.Forty-eight participants met the inclusion criteria 24 in each group. Written consent was taken and recruited in the study from tertiary health care centers Belagavi.Outcome measures were taken pre-treatment, 1st session, and post-treatment, 6th session. The study was conducted between March 2017 and February 2018.

Inclusion Criteria: Subjects clinically diagnosed with non-specific low backache, Hamstring tightness - Active Knee Extension Test [AKET] (>20˚ of knee extension lag), 18-40 years of age, males and females and subjects who are willing to participate.

Exclusion Criteria: Previous surgeries of the lumbar spine, Radiating pain, Neurological deficits, Tumours of the spine, Spondylolisthesis, Ankylosing spondylitis, infection of spine or TB spine, systemic infections.

Outcome measures: Numeric Pain Rating Scale (NPRS), Active knee extension test (AKET), Lumbar lordosis (θ), Quebec back pain disability scale (QBPDS).

The NPRS is an 11-point scale from 0-10.0 is no pain, 10 is the most intense pain imaginable. The subject marked a value on the scale with the intensity of pain that they had experienced in the last 24 hours. The NPRS had good sensitivity. (MCID- 2 points)

Active Knee Extension test was done to assess the Hamstring flexibility. The subject was in a supine lying position, and hip and knees bent to 90˚-90˚. Then the subject was asked to extend his knees actively. Knee extension (lag >20˚) was measured for both lower extremities (Figure 1). Lumbar lordosiswas calculated using Flexicurve. The index

is represented by the equation .

To assess the curvature, the subject stood in the normal anatomical position with the therapist standing behind. Twelfth thoracic (T_{12}) and second sacral (S_2)vertebrae were the markers to evaluate lumbar curvature. To identify S_2, posterior superior iliac spine (PSIS) was marked. The mid-point between the two PSIS was considered as the spinous process of the S_2.

To identify T_{12}, lower back above the iliac crest was palpated; this was the L_4 spinous process. By counting up the vertebrae, T_{12} spinous process was identified. Then, the flexible ruler was placed on T_{12} and S_2 and pressed on the ruler to eliminate the gap between the ruler and the skin. Then ruler was kept on a graph sheet, and the lumbar curve was drawn afterward. Then formula was used to substitute the values and find θ [9](Figure 2).

Figure 1: Active Knee Extension Test.

Figure 2: Measuring Lumbar Lordosis

Quebec back pain disability scale is a questionnaire about the way low backache is affecting daily life. Subjects with back problems may find it difficult to perform some of their daily activities. This questionnaire has 20 questions related to activities of daily living and a scale of 0 to 5 for each activity minimum detectable change is 90 % (15 points).

Intervention:

Group Areceived Mulligan's BLR technique.Group B received M2T for Hamstrings. TENS and exercises were common in both groups. Treatment was for sixsessions.

Mulligan BLR for Group A: Therapist was standing at the side of the subject. Hip and knee in 90° flexion and heel off the plinth. Subject holds the plinth from the unaffected side and places the hand of the affected side under his head and neck. Therapist Position was walk stance, lateral to the affected side. Therapist's shoulder of inner hand was placed under, proximal to the popliteal fossa. Therapist grasped the lower end of the thigh with both the hands. Longitudinal traction was applied along the long axis of the femur and took the hip into flexion until the first resistance was felt. If the subject complained about the stretch pain, then contract-relax was applied by asking the subject to push the therapist's shoulder gently for 5 seconds. Then the leg could be taken to a new pain-free range. If the subject had 'THE' pain, then the hip was moved into abduction or external rotation or more traction was given before further hip flexion was added. The end position was maintained for about 20 seconds. This technique was repeated for three times [10] (Figure 3).

[M2T] for Hamstring muscle for Group B:

The subject was in a prone lying position with the posterior part of the thigh exposed. Vaseline or cream or aqua gel was applied to the subject's skin to prevent irritation. The Hamstring was assessed with the blade. Knee was relaxed around 25˚- 45˚ flexion and rested on the therapist's arm. The blade was held at 45˚, mild to moderate pressure in the form of fast strokes were given for 30 sec [14] (Figure 4).

Figure 3: Mulligan's BLR technique

Figure 4: M2T for Hamstring muscle

EXERCISES

TENS and Conventional exercises like isometric for lumbar muscles, Bridging, trunk rotation, cat and camel exercises, partial curls, side planks, extension exercises like elbow press were taught.Ten repetitions were performed once with the treatment and were instructed to repeat the same exercises at home, as it should be done three times a day.

Statistical analysis:

Statistical analysis was done using the statistical package of social sciences (SPSS) version 20. Descriptive statistics, including mean ± SD, was calculated for all variables. Nominal data from the subject's demographic data distribution

was analyzed using Chi-square test. Variables for outcome measures testing was done using a Kolmogorov Smirnov test. They followed a normal distribution. Therefore parametric tests were applied. Probability values less than 0.05 was considered statistically significant, and probability values less than 0.001 was considered highly significant.

RESULTS

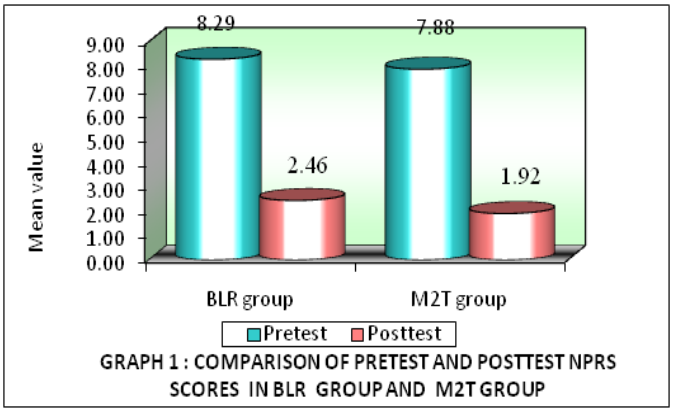
Out of 48 subjects aged between 18 to 40 years, with a mean age of 34.27 ± 5.30 years, 15 were male and nine female in BLR group. 12 male and 12 female in M2T group. Duration of symptoms for group A and group B was 15.90 ± 27.17 and 16.85 ± 24.20 months, respectively.(Table 1)

Variable		Group	Mean ±SD	No. of subjects in each group
Age in years		BLR	34.29 ± 5.58	
		M2T	34.25 ± 5.03	
Duration of symptoms		BLR	15.90 ± 27.17	
		M2T	16.85 ± 24.20	
Gender	BLR	Male		15
		Female		9
		Total		24
	M2T	Male		12
		Female		12
		Total		24

Table 1: Age distribution, duration of symptoms, and Gender distribution.

Numeric pain rating scale [NPRS]:The mean difference of pre and post-treatment scores and percentage change in group A [BLR] was 5.96±0.95 and 71.86 %,and group B [M2T] was about 5.71± 1.20 and 72.49%.

P-value was p=0.0001 for both the groups, which is statistically significant but was not significant between the groups suggesting, NPRS significantly reduced within-group but not between groups. (Graph 1, Table 2)



GRAPH 1 : COMPARISON OF PRETEST AND POSTTEST NPRS SCORES IN BLR GROUP AND M2T GROUP

Groups	Pretest	Posttest	Difference
	Mean ± SD	Mean ± SD	Mean ± SD
BLR group	8.29 ± 0.86	2.46 ± 1.14	5.96 ± 0.95
M2T group	7.88 ± 1.33	1.92 ± 1.14	5.71 ± 1.20
% of change in BLR			71.86%#, p=0.0001*
% of change in M2T			72.49%#, p=0.0001*
t-value	1.2901	1.6458	0.7999
p-value	0.2035	0.1066	0.4279

Table 2: NPRS

Active knee extension test: Right side

Mean difference and percentage change for group A [BLR] was 19.38 ±7.28 and 57.34%, and group B [M2T] was 17.00± 6.94 and 37.23%.

The p-value for within-group for both the groups was p = 0.0001, which is highly significant. And the difference of p-value between groups was 0.2532, which is not significant suggesting that there was an improvement in AKET within the group but not between groups on the right side(Table 3).

Groups	Pretest	Posttest	Difference
	Mean ± SD	Mean ± SD	Mean ± SD
BLR group	33.79 ± 13.20	14.42 ± 11.37	19.38 ± 7.28
M2T group	45.67 ± 17.42	28.67 ± 17.16	17.00 ± 6.94
% of change in BLR		0.0007	57.34%#, p=0.0001*
% of change in M2T		0.0012	37.23%#, p=0.0001*
t-value	-2.6619	-3.3915	1.1571
p-value	0.0107	0.0014*	0.2532

CTable 3: Right AKET

Left side: The mean difference and percentage change in group A [BLR], was 20.54±6.78 and 59.90% and group B [M2T] was 15.75±6.50 and 35.49%.The p-value for within-group for both the groups was p = 0.0001, which is highly significant, and the difference of p-value between groups was 0.0161, which is significant. Therefore there was an improvement in AKET for both within-group and between groups on the left side (Table 4).

Groups	Pretest	Posttest	Difference
	Mean ± SD	Mean ± SD	Mean ± SD
BLR group	34.29 ± 13.25	13.75 ± 11.58	20.54 ± 6.78
M2T group	44.38 ± 15.79	28.63 ± 16.36	15.75 ± 6.50
% of change in BLR			59.90%#, p=0.0001*
% of change in M2T			35.49%#, p=0.0001*
t-value	-2.3957	-3.6353	2.4984
p-value	0.0207	0.0007*	0.0161*

Table: 4 Left AKET

Lumbar lordosis: The p-value between groups was p = 0.5990,which was not statistically significant suggesting BLR or M2T was not effective in improving lumbar lordosis (Table 5).

Groups	Pretest	Posttest	Difference
	Mean ± SD	Mean ± SD	Mean ± SD
BLR group	36.46 ± 13.84	38.53 ± 13.29	2.07 ± 6.49
M2T group	41.29 ± 15.59	42.49 ± 14.66	1.20 ± 4.76
% of change in BLR			5.68%#, p=0.1317
% of change in M2T			2.91%#, p=0.2289
t-value	-1.1367	-0.9824	0.5296
p-value	0.2616	0.3310	0.5990

Table 5: Lumbar Lordosis

Quebec back pain disability scale: The mean difference and percentage change in group A [BLR], was 28.38 ± 9.73 and 48.44%, and in group B [M2T] it was 26.42 ± 11.38 and 48.10%.

The p-value within-group was p= 0.0001, which is statistically significant, and between-group was 0.5249, which was not statistically significant, suggesting a statistical significance in QBPDS score within-group but not between groups(Table 6).

Groups	Pretest	Posttest	Difference
	Mean ± SD	Mean ± SD	Mean ± SD
BLR group	58.58 ± 13.08	30.21 ± 6.53	28.38 ± 9.73
M2T group	54.92 ± 18.12	28.50 ± 13.82	26.42 ± 11.38
% of change in BLR			48.44%#, p=0.0001*
% of change in M2T			48.10%#, p=0.0001*
t-value	0.8038	0.5475	0.6407
p-value	0.4256	0.5867	0.5249

Table 6: QBPDS

DISCUSSION

The study showed a significant improvement in both groups in terms of NPRS for pain. This improvement in pain can be attributed to the intervention of stretching of the hamstring muscle in case of BLR and release of the fascia over the hamstring in case of M2T blade.

The reduction in the pain following the BLR could be because of inhibitory effects in the Golgi tendon organs, which reduces the motor neuronal discharges on stretching, thereby causing relaxation of the musculotendinous unit by resetting the resting length and Pacinian corpuscle modification. These reflexes will allow relaxation of the musculotendinous unit and hence decrease the pain perception [12].

A study done by Marcia A. Esola et al. (1996) found out that hamstring flexibility was strongly correlated to movements in the lumbar spine in subjects with a history of low back pain. They concluded that teaching hamstring stretching may be helpful in such subjects. The present study is by this study that supports hamstring flexibility contributes to the improvement of low back pain symptoms [13].

In the case of M2T, the pain reduction may be due to the Golgi tendon organs. When stimulated, they will cause a myotatic stretch reflex that causes the muscle to contract and relax. When a change in tension is sustained at an adequate intensity and duration, muscle spindle activity is inhibited, causing a decrease in the trigger point activity, resulting in pain reduction [14].

Also, in M2T, the mechanical load on the superficial skin is higher than that of the deeper tissues. There can be two contrast effects that may occur: first, IASTM may lead to increased neural activities of large fiber neurons and therefore decrease the pain perception based on gate control theory. Or the IASTM may lead to decreased neural activities of both large and small-fiber neurons due to neural accommodation initiated by the increased deformation and mechanical stimulation [15].

Jeong - Hoon Lee et al. (2016) studied the effects of the Graston technique on pain and ROM in patients with chronic low back pain. Both the Graston technique and general exercise-induced increased ROM. However, only the Graston group showed more pain relief and increased ROM in CLBP subjects. This study supports our results [16].

The effect of TENS might have contributed to pain reduction. TENS applied causes increased extracellular GABA concentration in the dorsal horn of the spinal cord. GABA is an inhibitory neurotransmitter that is involved in analgesia at the spinal level [17].

Marchand S et al.(1993) found out that TENS had significantly decreased the pain in comparison with placebo TENS, and also TENS had an additive effect for a short term of 1 week. So adding TENS in the study might have contributed to the reduction in pain [18].

The study showed that there was an improvement in hamstring flexibility in terms of AKET in both lower limbs. Reasoning could be due to the responses of the nervous system to stretching. Herda et al. (2009) reported that a prolonged stretch of the muscle spindles inhibited their afferent activity, which can decrease muscle tension [19].

In BLR, there is stretching of the gluteus maximus, and adductor part of the hamstring muscle, which helps in breaking the adhesion in between the muscles. BLR might also have helped in stretching and releasing thoracolumbar fascia.

Kristin Eid et al. (2017) study on the application of instrument-assisted soft tissue mobilization on the upper and lower part of the superficial back line on hamstring flexibility was effective in subjects with hamstring deficiencies. Benefits were found in groups who received IASTM [20]. Hence it was effective in treating hamstring flexibility in subjects with hamstring shortness, and their results support this study. There was no statistical significance seen in the effect of the intervention in both the groups for lumbar lordosis. In BLR during end range of hip flexion, the pelvis goes for posterior tilt as we passively stretch the hamstring muscle, where the origin is pulled or stretched. This might have caused posterior pelvic tilt, causing reduced anterior pelvic tilt and therefore reduce the lumbar lordosis.

The normal range for lumbar lordosis is 33.2˚ ± 12.1˚. Therefore as the normal range is wide, the clinical improvement may not be statistically evident.Since the pelvis is already in posterior pelvic tilt, BLR technique might not have been effective in reducing the posterior pelvic tilt. Hence the results might not have been statistically significant. BLR targets the hamstring muscle, and it does not affect the erector spinae muscle, which is responsible for maintaining the lordosis angle naturally. So there may be no statistical significance in the results for lordosis.

Ho-Jun Kim et al.(2006) interpreted that the major extensor of the spine, erector spinae, increases the lumbosacral angle functionally [21].Since the study is focussing on the

effect of BLR on hamstring muscle and no effect is occurring directly on erector spinae muscle, and M2T blade has been used on the hamstring muscle, and its action is limited to the hamstring muscle and fascia only. Therefore there may be no effect of M2T blade on lumbar lordosis.The improvement in QBPDS could be due to an overall improvement in the pain and hamstring flexibility that might have improved the functional ability of the individual.

In Demoulin C et al. (2010) study, they used QBPDS pre-treatment and post-treatment in 212 subjects with chronic low back pain. They observed a smallest detectable change of 15.8 points in the scale. They concluded that QBPDS was responsive and showed reasonable interpretability after a multidisciplinary treatment [22].

In this study, QBPDS showed statistically significant response post-intervention in both groups.

CONCLUSION

Both Mulligan's BLR and M2T interventions were equally effective in improving pain, hamstring flexibility, and functional scale (QBPDS) but not in Lumbar lordosis in subjects with hamstring tightness in non-specific low backache.

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