

Original Article

EFFICACY OF MULLIGAN'S TWO LEG ROTATION AND BENT LEG RAISE TECHNIQUES IN HAMSTRING FLEXIBILITY IN SUBJECTS WITH ACUTE NON-SPECIFIC LOW BACK PAIN: RANDOMIZED CLINICAL TRIAL.

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ABSTRACT

Background and objectives: Adequate flexibility of the Hamstring muscles and Core muscle strength is necessary for a healthy lower back. Mulligan's techniques are fascinating Physiotherapy approach in treatment of hamstrings tightness in NS-LBP such as Mulligan's Bent Leg Raise (BLR) technique, Limited Literature is available on the efficacies of Mulligan's Two Leg Rotation (TLR) technique in Hamstrings flexibility. The objective of the present study was to determine the effectiveness of Mulligan's TLR and BLR in treatment of acute NS-LBP.

Methods: The present randomized clinical trial was conducted among 40 subjects which included both male and female symptomatic subjects between the age of 18 to 35 years with acute NS-LBP and they were randomly allocated into 2 groups namely Group A [SWD, HMP, Mulligan's TLR, MCE] , Group B [SWD, HMP, Mulligan's BLR, MCE]. Pre-interventional and 7th day Post-interventional outcome measurements were taken in the form of Visual Analogue Scale (VAS), Modified Oswestry Disability Questionnaire (MODQ), Active Knee Extension (AKE) Measurement, Lumbar ROM and Core muscle strength.

Results: Intra-group comparison for all the outcome parameters in both the groups showed statistical significance ($p < 0.001$). Inter group comparison for all the outcome parameters had differences but showed no statistical significance.

Conclusion: Mulligan's Two Leg Rotation and Bent Leg Raise techniques are effective in increasing the hamstrings flexibility in subjects with acute non specific low back pain in terms of pain, range of motion and functional disability.

KEYWORDS: Acute Non-specific low back pain; Hamstrings tightness; Mulligan's Two Leg Rotation; Mulligan's Bent leg Raise; Motor Control Exercise, CTRI No.: CTRI/2014/09/005068.

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INTRODUCTION

The term low back pain refers to pain in the lumbo-sacral area of spine encompassing the distance from 1st lumbar vertebra to the 1st sacral vertebra. This is the area of the spine where the lordotic curve forms.¹ Low back pain

has been with humans since at least the Bronze Age.² Low back pain (LBP) is a problem world-wide with a lifetime prevalence reported to be as high as 84% by World Health Organization (WHO).⁵ It occurs in similar proportions in all cultures, interferes with quality of life and work

performance, and is the most common reason for medical consultations.³ In India occurrence of low back pain is also alarming, it has been reported to be 23.09%.⁴ Half of the population will have experienced a significant incident of low back pain by the age of 30 years.⁵

Based on the etiology LBP is classified as Specific LBP and Non-specific LBP. Of all the LBP patients 90% are attributed to Non-specific causes, a disorder which is a health problem of high economic importance. Specific LBP causes are nerve root compression, vertebral fracture, tumor, infection, inflammatory diseases, spondylolisthesis or spinal stenosis.⁶ Non-specific causes do not have a specific pathology.

Non-specific low back pain is defined as low back pain not attributable to a recognizable, known specific pathology (e.g., infection, tumor, osteoporosis, fracture, structural deformity, inflammatory disorder, radicular syndrome.)⁷ Based on the duration Non-Specific LBP (NS-LBP) is classified Acute (Less than 6 weeks), Subacute (6 weeks – 3 Months) and Chronic (More than 3 Months).⁸

Following are considered as risk factors for NS-LBP: Poor Hamstrings muscular flexibility, Poor abdominal strength and Increased level of physical activity and work related postural stress.⁹ Hamstrings muscle is a postural muscle and as it is biarticular, it has tendency to shorten even under normal circumstances.¹⁰ Since it is a superficial two joint muscle, they tend to become very tight leading to a muscle imbalance, which can give rise to number of postural problems and leave us open to muscle injury.¹¹ Tight Hamstrings usually start at the age of 5 or 6 years, when children start their seated school careers. Prevalence and incidences of Hamstrings tightness in non-specific LBP individuals is high due to limited activity and lack of regular exercise.¹² Investigations suggest adequate flexibility of the Hamstring muscles is necessary for a healthy lower back.¹³

The degree of stability and support of the trunk area is largely dependent on strength of supporting structures, the muscles. Improper vertebral alignment can result from weak back extensor muscles which may lead to undue loading on the spine. Patients with low back pain

exhibit decreased levels of trunk extension, trunk flexion, and lateral flexion strength, when compared to non-suffering persons.^{13,14}

The flexibility of the Hamstrings provides for a functional mechanical advantage, while tight or shortened hamstring muscles adversely affect spinal mechanics.¹⁵ A lack of pelvic mobility, due to tightness in the hamstring muscles and impaired core muscles strength, could limit pelvic mobility and cause strain on the lumbar spine. In addition, tight hamstring and reduced core muscles strength could reduce the lordotic curve, which may impair spinal loading and alteration in the Lumbar Pelvic Rhythm will generate more strain on the lumbar segment giving rise to LBP.^{16,17}

There is no unanimous opinion regarding the proper method of treatment for Non-Specific LBP, the basic principle of treatment being to reduce the pain. Various methods of therapeutic interventions have been recommended for Non-specific LBP. To regain the Core Muscle Strength, Motor Control Exercises (MCE) has been recommended for subjects with acute Non-specific LBP. There is a need for intervention along with the Motor Control Exercise to prevent the recurrence of back pain.

Since decades studies have been made available for the use of Stretching techniques for Hamstrings flexibility. Several Studies on Mulligan's techniques have proved their efficacies in improving Hamstrings flexibility. Mulligan's Two Leg Rotation Technique (TLR) is a new technique that has been developed by Dr. Brain R Mulligan and colleagues (2010) and is a painless technique, and can be tried in any patients with hamstrings tightness, low back pain and who has limited and/or painful straight leg raise (SLR). It can be extremely useful in patients who have a gross bilateral limitation of straight leg raising.¹⁸

There is a paucity of studies published in the peer reviewed literature that have compared the efficacies of Mulligan's Two Leg Rotation and Bent Leg Raise techniques in Hamstrings flexibility. So the Present study intended to compare the effectiveness of Mulligan's Two Leg Rotation and Bent Leg Raise techniques in subjects with Acute Non-specific LBP and to determine whether a difference of treatment

efficacy exists among the two mulligan's Techniques.

METHODS

This study was conducted at Physiotherapy OPD and Orthopaedics wards of KLES Dr. Prabhakar Kore Hospital & MRC Belgaum, KLES Shri. B.M. Kankanwadi Ayurveda Hospital & MRC Belgaum during the study period from February 2013 to January 2014. Study design is Randomized Clinical Trial. Materials used for the study were universal goniometer, measuring tape, mulligan's belt, pressure biofeedback unit by Chattanooga group. 40 subjects were included in the study based on the inclusion criteria. Subjects were randomly allocated into the two groups by envelop method. 20 subjects in each group.

Inclusion criteria for the study subjects were 1. Both male and female, Age group 18 to 35 years of age. 2. LBP with no specific pathology. 3. LBP less than 6 weeks, Active Knee Extension (AKE) measurement more than 15 degree, Core muscle weakness. 4. Subjects who are able to comprehend command and willing to participate in the study.

Exclusion criteria for the study subjects were 1. Subjects with LBP with trauma. 2. LBP with specific pathology. 3. Any neurological symptoms involving prolapsed intervertebral disc, radiating pain. 4. History of any recent Abdominal, Back Surgeries 5. Any contra-indication for exercise, SWD. 6. Pregnancy, Psychological risk factor, Subjects apprehensive for the Stretching Techniques were excluded from the study.

Ethical clearance was obtained from the ethical committee of the institution prior to the commencement of the study. Based on eligibility criteria subjects were included by simple random method and these subjects were randomly divided into two groups, Group A (Mulligan's TLR) and Group B (Mulligan's BLR). Prior informed consent forms were signed by every subject included. All the subjects were explained about need for the study, confidentiality of the documentation, procedure for the measurements, and the treatment procedure. Baseline Measurements prior the treatment was conducted that is VAS for Pain, MODQ for func-

-tional disability index, AKE measurement for hamstrings flexibility, Lumbar ROM, Core muscle strength and these outcomes were again assessed on 7th day post treatment

Intervention: Group A- Subjects received SWD for the lower back region for treatment time 10mins, HMP for the hamstrings muscles prior the stretching technique for 10mins, Mulligan's TLR technique, Motor control exercises.

Mulligan's Two Leg Rotation: Therapist stands at the limited hamstrings flexibility side of the supine subject on the plinth and grips the side of the plinth with the opposite side hand. Both legs will be flexed so that the feet are off the plinth. Keeping his (subject's) shoulders on the bed he takes his (subject's) legs slowly to the side of the limited hamstring muscle flexibility. When he (subject) reaches limit, the position is sustained for 30 seconds with over pressure applied by the therapist and then lower the legs to the plinth and repeat for 3 repetitions, and 1 minute rest between each stretch. And same procedure is done for the other side of limited hamstrings flexibility. (Fig. 1)

Fig. 1: Mulligan's TLR technique.

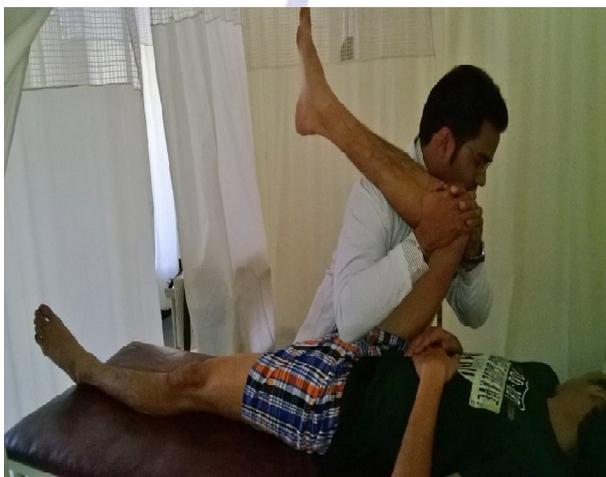


Group B- Subjects received SWD for the lower back region for treatment time 10mins, HMP for the hamstrings muscles prior the stretching technique for 10mins, Mulligan's BLR technique, Motor control exercises.

Mulligan's Bent Leg Raise: Therapist stands at the limited hamstrings flexibility side of the supine subject on the plinth. Therapist place the subject's flexed knee over his (therapist's) shoulder and now asks the subject to push the

therapist with his leg and then relaxes. At this point therapist push his (subject's) bent knee up as far as possible in the direction of his (therapist's) shoulder on the same side. Sustain this stretch for 30 seconds and then lower the leg to the plinth and repeat for 3 repetitions, and 1 minute rest between each stretch. And same procedure is done for the other side of limited hamstrings flexibility. (Fig. 2)

Fig. 2: Mulligan's BLR technique.



Motor Control Exercises (MCE): Subjects in both groups received motor control exercises following mulligan's technique in the form of following exercises, with 8 seconds hold and 20 repetitions each.

1 session/day for 7 sessions.

- 1) Abdominal draw in.
- 2) Abdominal draw in with heel slides.
- 3) Abdominal draw in with leg lifts.
- 4) Abdominal draw in with bridging.
- 5) Quadruped arm lift with abdominal draw in.
- 6) Quadruped leg lift with abdominal draw in.
- 7) Quadruped alternate arm and leg lift with abdominal draw in.
- 8) Side bridging on elbows with knees flexed abdominal draw in.
- 9) Side bridging on elbows with knees extended abdominal draw in.
- 10) Trunk curls.

OUTCOME MEASURES:

1. Pain Intensity: Pain score of the subjects involved in this study were recorded by using the Visual analogue scale (VAS) both at rest and activity. VAS is a 10 cm straight line drawn on a paper marked with numbers 0 to 10 where 0 symbolized no pain and 10 symbolized the worst

tolerable pain and subjects were asked to mark a point on this line as per the severity of his/her pain which indicates present pain level.

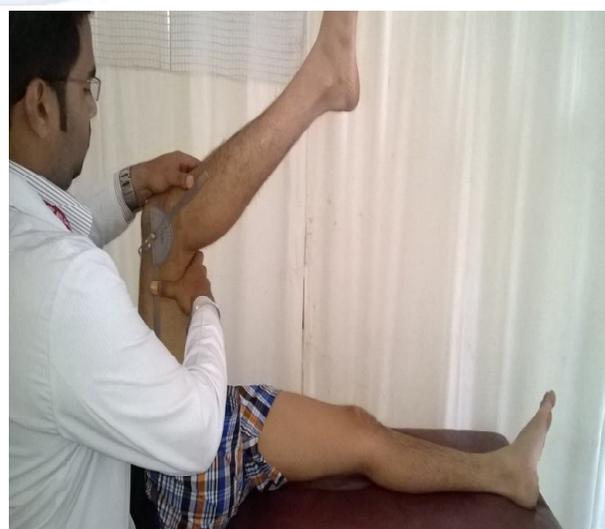
2. Modified Oswestry Disability Scale (MODS):

Percentage of functional disability was calculated by Modified Oswestry Disability Scale (MODS). A well validated, self-report questionnaire designed for low back pain contains 10 sections. For each section the total possible score is 5. If the first statement is marked the section score is 0, If the last statement is marked the section score is 5. Total score is calculated in percentage, where better functions are indicated by lower scores.¹⁹

3. Active Knee Extension (AKE) Measurement:

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 ilia to stabilize the pelvis. Subject then flexed his hip to 90 degrees (the angle was confirmed with a universal goniometer) and subject was instructed to grasp behind the knee with both the hands to stabilize the hip at 90 degree of flexion. Subject then actively extended each knee in turn as far as possible. Fulcrum of the universal goniometer was placed over the centre of axis of knee joint and AKE was measured. (Fig. 3)

Fig. 3: AKE measurement.



AKE test is a reliable and valid tool in measuring the hamstrings muscle tightness, with reliability coefficients for test measurements were 0.99 and reliability coefficients for retest measurements were 0.99.²⁰

4. Lumbar Range Of Motion: Lumbar flexion and extension range of motion is measured using standard technique of measuring range with the help of modified schobbers method using an inch tape. (Fig. 4, 5)

Fig. 4: Lumbar Flexion ROM.

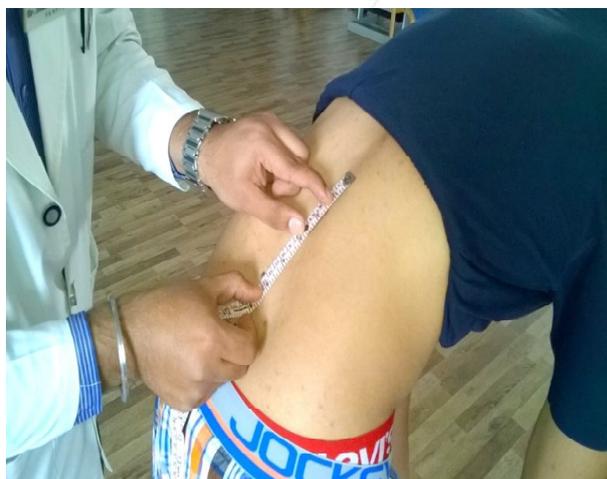


Fig. 5: Lumbar Extension ROM.



5. CORE MUSCLE STRENGTH: Pressure biofeedback was used to measure the core muscle strength. The stabilizer is a three chamber pressure cell. The three-chamber pressure cell was positioned under the lumbar spine while the subject is in crook lying and inflated to a baseline of 40 mmHg. The subject draws in the abdominal wall without moving the spine or pelvis. The measuring range is from 0 to 200 mmHg analog pressure with an accuracy of +/- 3mmHz pressure.

RESULTS

Data was computed and analyzed using SPSS (Statistical Package for Social Science) software version 16. Mean and Standard Deviation were calculated for Pre and 7th Post treatment data for all the outcome measures in both the groups.

Test of Significance namely paired t –test, Mann–Whitney U tests were used to compare the data. Level of significance was set up at $p < 0.005$. Inter and intra group differences were compared to evaluate the effectiveness of the treatment protocols given to the two groups.

Demographic Details

There was no statistically significant difference in the mean age, Body Mass Index (BMI) of the two groups Group A (TLR group) and Group B (BLR group). (Table 1)

Table 1: Demographic Details of Group A and Group B.

	No. of Males	No. of Females	Age (years)	BMI (Kg/meter ²)
Group A	13	7	29.1 ± 5.13	23.7 ± 2.19
Group B	9	11	27.2 ± 6.50	22.9 ± 1.94
t			1.053	1.231
p value			0.229	0.226

Visual Analogue Scale (VAS) scores at REST and ACTIVITY (Cm)

Group A and Group B the difference of mean of VAS scores at rest and at activity pre and 7th day post treatment had intragroup differences statistically significant ($p < 0.001$) but intergroup differences showed no statistical significance. (Table 2)

Table 2: Comparison of VAS scores at REST and ACTIVITY [Cm].

	REST			ACTIVITY		
	Group A	Group B	Inter. p	Group A	Group B	Inter. p
Pre	3.6±0.79	2.8±0.83	0.01	5 ± 0.71	4.5±0.82	0.035
Post	1.8±0.59	1.2±0.57	0.003	3.4±0.75	3±0.95	0.148
Diff.	1.82±0.67	1.6±0.52	0.189	1.6±0.65	1.5±0.42	0.461
Intra. p	<.001	<.001		<.001	<.001	

Modified Oswestry Disability Questionnaire (MODQ) Score (%):

Group A and Group B the difference of mean of MODQ scores pre and 7th day post treatment had intra-group differences statistically significant ($p < 0.001$) but intergroup differences showed no statistical significance. (Table 3)

Table 3: Comparison of MODQ Score [%].

	PRE Score	POST Score	Difference	Intra. p
Group A	38 ± 2.97	19.9 ± 2.47	18.1 ± 1.37	< .001
Group B	38 ± 7.75	18.7 ± 1.75	19.3 ± 6.49	< .001
t	0	1.773	0.808	
Inter. p	1	0.084	0.424	

Active Knee Extension (AKE) measurement (degrees):

Group A and Group B the difference of mean of AKE scores for both right and left pre and 7th day post treatment had intra-group differences statistically significant ($p < 0.001$) but intergroup differences showed no statistical significance.

(Table 4)

Table 4: Comparison of AKE scores for RIGHT and LEFT [degrees].

	RIGHT			LEFT		
	Group A	Group B	Inter. p	Group A	Group B	Inter. p
Pre	32.55±11.3	29.35±11.75	0.38	32.05±8.78	29±11.91	0.363
Post	24.2±9.65	20.95±10.21	0.308	24.25±8.70	20.85±10.34	0.268
Diff.	8.35±3.46	8.4±2.93	0.961	7.8±3.62	8.15±3.33	0.752
Intra. p	<.001	<.001		<.001	<.001	

Lumbar Range Of Motion (ROM) (Cm):

Group A and Group B the difference of mean of Lumbar ROM scores for both flexion and extension pre and 7th day post treatment had intra-group differences statistically significant ($p < 0.001$) but intergroup differences showed no statistical significance. (Table 5)

Table 5: Comparison of Lumbar ROM scores for FLEXION and EXTENSION [Cm].

	FLEXION			EXTENSION		
	Group A	Group B	Inter. p	Group A	Group B	Inter. p
Pre	17.4±1.32	17.3±1.01	0.79	13.5±0.67	13.5±0.58	0.901
Post	19.4±1.46	19.5±1.69	0.805	12.1±0.79	11.8±0.69	0.214
Diff.	2 ± 0.89	2.2±1.39	0.547	1.4±0.73	1.7±0.59	0.133
Intra. p	<.001	<.001		<.001	<.001	

Core Muscle Strength (mmhg):

Group A and Group B the difference of mean of core muscle strength scores pre and 7th day post treatment had intra-group differences statistically significant ($p < 0.001$) but intergroup differences showed no statistical significance.

(Table 6)

Table 6: Comparison of Core Muscle Strength [mmhg].

	PRE Score	POST Score	Difference	Intra. p
Group A	51.1 ± 3.59	56.4 ± 4.95	5.3 ± 2.65	<.001
Group B	50.5 ± 2.83	56.1 ± 2.71	5.6 ± 1.31	<.001
t	0.586	0.237	0.453	
Inter. p	0.562	0.814	0.653	

DISCUSSION

The present study was conducted to compare the effectiveness of Mulligan's TLR technique

and Mulligan's BLR technique for hamstrings flexibility in acute non-specific low back pain. In the present study demographic data of the subjects taken, was homogenous for both the groups, it can be said that acute NS-LBP can be seen in adults between the age groups of 18-35 years of age as compared to the other age groups because of the reduced hamstrings flexibility, poor abdominal strength. Tight hamstrings usually start as early at the age of 5 or 6 years when children start their seated school careers, intensity of tightness increases at adolescents, and peaks at 25 years when an individual involves in profession or gets occupationally linked.²¹ Grenier SG defined the age group to be 21 to 37 years. When one sits in a standard chair, some important postural control muscles are inactivated, while others are being asked to work overtime. The finding of this study correlated with above reference since maximum number of subjects were in the age group of 18 to 35 years.²²

Altered or decreased lumbar ROM is associated with NS-LBP. Subjects in the present study had reduced lumbar ROM for flexion and extension which was demonstrated by modified schober method in this study. Debbie Ehrmann carried out a study between low back pain subgroups and gender, assessed differences in end range lumbar flexion. Results of the study support the proposal that people with low back pain display stereotypic patterns of posture and movement.²³

Visual Analogue Scale is a reliable tool for acute as well as chronic pain.²⁴ In the present study, intergroup group VAS reduction both at rest and activity had differences but showed no statistical significance with p value more than 0.05 with Group A reporting better improvements with no statistical significance. The reduction of VAS scores in group A might be due to the combination effects of SWD, Mulligan's TLR and MCE which helped in alleviating pain. Reduction in VAS scores both at rest and activity are in accordance to the findings of Shabana Khan and Sharick Shamsi study which had better outcome post intervention as a combination of SWD and exercise.²⁵ Also these observed improvements are similar to the findings of the study by Chris G Maher, Jane Latimer et al where motor control

exercise and SWD were given in combination to one group and the group that only received SWD.²⁶In the present study, analyzed MODQ scores showed that there were intragroup differences for both the groups which had statistical significance but intergroup differences were not statistical significant. This shows that both the groups that is group A (TLR) and group B (BLR) were equally effective in reducing the percentages of MODQ. Results of the study performed by Julie et al indicate that the measurements properties of MODQ are preferable. The test-retest reliability over a 4 week period was higher and was more responsive for MODQ.²⁷ In the present study only seven sessions over a period of two weeks was used which showed no statistical significance for intergroup difference. Davidson M, Keating JL et al stated MODQ as a tool which was most reliable and responsive means to obtain responses from the patients related to their pain and daily life events out of the five low back disability questionnaires.²⁸

Mulligan stated that improvements in hamstrings flexibility by means of Bent Leg Raise and Two Leg Rotation could be due to unknown possible mechanism or like he describes it, "How it happens. Who Knows??"¹⁸ In Mulligan's BLR and TLR stretching, the muscle is slowly elongated to tolerance and the position is held with the muscle in its greatest tolerated length. The AKE measurements assessed on the post 7th session had significant improvements in BLR group which had improved largely as compared to those reported by Toby Hall et al in their study where they reported increase in straight leg raise measurement by 7 degrees in similar patients of low back pain.²⁹ while the AKE measurements reported for TLR technique group were also considerably more as compared to those reported by Toby Hall et al.

In another study by Toby Hall et al, our reported improvements in AKE were less, were in their study he reported increase in straight leg raise by 11 degrees on application of Mulligan's Traction Straight Leg Raise technique in patients with LBP and painful straight leg raise.³⁰ However in our study these difference could exists as individuals with any neurological symptoms or prolapsed inter vertebral disc were excluded

which may be the reason for painful straight leg raise. Various research over Mulligan's BLR method suggest it as contract relax method were contract relax cycles applied to hamstrings provide peripheral somatic input to the contracting muscle.²⁹

After extensive search there were no reported studies involving the effects of Mulligan's TLR or its comparative studies comparing with the other stretching protocols. The beneficial increase in the hamstrings flexibility post 7th day intervention might be due to change in muscle stretch tolerance of hamstrings and through decreases in viscosity (stiffness) and increases in compliance of muscle, which in turn results in hamstrings lengthening. This could be another explanation to the increase in hamstrings muscle flexibility in both the groups.³¹

In the present study, lumbar ROM for flexion and extension in both the groups had improvements which were statistical significant. As a result to the improvements in hamstrings flexibility there was lengthening in the muscle length which relieved the pelvis of its excess posterior rotation which improved the spine pelvis biomechanical function there by providing a efficient lumbo-pelvic rhythm to the lumbar range of motion. This phenomena was also justified by Mohammad Reza Nourbakhsh et al, the relationship between lumbar lordosis and short hamstrings muscle in subjects with low back pain and subjects without low back pain.³²

In the present study, analyzed Core muscle strength showed that there were intragroup differences for both the groups which had statistical significance but intergroup differences were not statistical significant. These observed improvements in core muscle strength 7th day post intervention in our study is in accordance to the findings of Chris G Maher, Jane Latimer et al study, although the improvements in their study were comparatively greater to the improvements of our study. This could be justified, as that the difference in number of sessions of the intervention MCE in Chris G Maher, Jane Latimer et al study.²⁶

Shannon et al and Addison et al reported the functional problems associated with tight hamstrings and hence with results obtained from

the present study, suggest to have a beneficial role in restoring the normal functional body mechanics to provide a healthy lower back. ^{14, 17}

Limitations: 1) Subjects could not be followed up after the study. 2) Universal goniometer was used which operates manually, investigator (human) errors were unavoidable.

Recommendations: 1) Studies with longer follow up period are recommended so that long term benefits can be assessed. 2) A larger sample size should be taken to conduct future studies. 3) Further studies are recommended to conduct on subjects having chronic low back pain due hamstrings muscle tightness and core muscle weakness.

CONCLUSION

The present study results demonstrates that both the treatment techniques that is Mulligan's Two Leg Rotation and Bent Leg Raise techniques are effective in increasing the hamstrings flexibility in subjects with acute non specific low back pain in terms of pain, range of motion and functional disability. Thus Mulligan's Two Leg Rotation can also be used commonly as other mulligan techniques in clinical practice for improving the hamstrings flexibility.

Conflicts of interest: None

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