

Comparison of Mulligan Bent Leg Raise (BLR) Versus Traction Straight Leg Raise (TSLR) Technique in Hamstring Tightness in Sewing Machine Operators with Low Back Pain

Dr. Pooja Bhosle¹, Dr. Syed Rais Akhter Rizvi²

¹Physiotherapy in Musculoskeletal Disorders and Sports Physiotherapy, KTG College of Physiotherapy, Bangalore.

²Professor and Principal, Anuradha College of Physiotherapy, Bangalore.

Corresponding Author: Dr. Pooja Bhosle

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ABSTRACT

Background and Objectives: Mulligans Bent Leg Raise (BLR) and Traction Straight Leg Raise (TSLR) both have been showed improvement in hamstring flexibility. The objective of the study was to find the comparative effect of Mulligans Bent Leg Raise (BLR) over Traction Straight Leg Raise (TSLR) in hamstring tightness in sewing machine operators with low back pain.

Methods: 40 sewing machine operators with Hamstring tightness in terms of Lack Of Active knee extension test more than 20° were randomly allocated in two groups. Group A (N=11; M=8, F=9) Mulligans Bent Leg Raise Technique and Group B (N=20; M=9, F=11) received Traction Straight Leg Raise technique. The outcome was assessed in terms of hamstring flexibility by Back saver sit and reach test and disability by Oswestry Low Back Pain Disability Questionnaire at pre and post intervention.

Results: The result of present study demonstrated that both the interventions in group-A (BLR) and group-B (TSLR) were found to be individually effective in treating sewing machine operators with hamstring tightness and low back pain in increasing BSSR in both right and left side and decreasing the disability. But, while compared the post test outcomes in between the groups, there was no much difference in between the groups.

Interpretation and Conclusion: The present study concludes that both the interventions of

Mulligans BLR and TSLR were individually effective in increasing the flexibility of hamstring and decreasing the disability due to low back Pain.

Key words: Sewing machine operators, Hamstring Tightness, Mulligan BLR and TSLR,

INTRODUCTION

Muscular flexibility is one of the most important aspect of normal human function¹. Lengthening ability of muscles allows one or more joint to move through range of motion is known as flexibility². Adaptive shortening of contractile and noncontractile element of muscle is termed as muscle tightness³. Decreased muscular flexibility is common problem that affect various patient as well as healthy individuals². Individuals flexibility is influenced by many factors which includes age, race, gender, tissue temperature, strength training, stiffness, warm-up etc⁴.

Biceps femoris, semitendinosus and semimembranosus are posterior femoral muscles which collectively termed as hamstring, which act as a postural muscle. It is a bi-articular muscle which crosses two joint hip and knee^{3,5}. It originates from ischial tuberosity and inserted into back of thigh. It functions as a hip extensors and knee flexors⁵.

Hamstring muscle belongs to the muscle group which has tendency to get shorten⁴. Hamstring tightness is predisposing factor for many of the musculoskeletal disorders such as low back pain, hamstring injury, patellofemoral pain, plantar fasciitis, hamstring strain etc^{5,1}. Limited flexibility can also be the underlying cause inefficiency in work place and is also a major risk factor for low back pain.²

Sitting prolong for an extended time period put load on the muscle with large amount of force increases risk of injury⁶. Hamstring muscle are inactive during chair sitting and are held at shortened position due to knee flexion and posterior pelvic rotation^{5,7}. Prolong sitting duration on chair may put pressure on the back of thigh and promote trigger point development in hamstring which can result in tightness. In this way hamstring tightness might happens as a result of sitting for prolong period of time⁷.

The jobs that require prolong sitting and educational setups are said affect the flexibility of the soft tissues so the two joint muscles like hamstring is particularly affected³. In sewing machine operator 83.4% prevalence of hamstring tightness is observed in dominant leg and 73.96% in nondominant leg⁵. Inability to achieve greater than 160°knee extension with hip at 90°of flexion is considered as hamstring tightness⁸.

Low back pain is a worldwide problem having prevalence rate of 84%by world health organization⁹. Men and women are equally affected by low back pain at the age between 30 to 50 years¹⁰. It is defined as a pain and discomfort localised below the costal margin and above the inferior gluteal folds with or without leg pain^{9,11}. No underlying pathological condition can be found as the cause of low back pain in most of the cases, called nonspecific low back pain¹² or it is defined as pain without any specific detectable cause¹³. More specifically it is a type of pain which is not caused by tumors, infections, trauma, spondylolisthesis, rheumatic spinal disease¹⁴

Active knee extension and Passive straight leg raise is most commonly used for the hamstring flexibility measurement^{15,16}. Other most commonly use test for measurement of hamstring flexibility are sit and reach test, passive knee extension test, stand and reach test.¹⁷

Universal goniometer is a frequently used instrument in physical therapy.it permit physical therapist to quantify restrictions in ROM¹⁸. Sit and reach test is a field test used to measure hamstring and low back Flexibility from all the sit and reach test back saver sit and reach test produce reasonably accurate measurement¹⁹.

In 1980 Oswestry low back pain disability questionnaire was originally described. The questionnaire addresses different aspects of human function with 10 items which includes pain intensity, personal care, lifting, walking, sitting, standing, sleeping, social life, travelling, employment or homemaking. For each item score is from 0 to 5. Higher the score represents higher disability²⁰.

There are various methods of treatment are available for improving hamstring flexibility, in clinical practice Mulligan manual therapy techniques are more frequently used⁸. There are several studies on mulligan technique which proves its efficiency in improving hamstring flexibility³. Dr Brain R Mulligan developed new technique bent leg raise (BLR), which considered as a painless technique and used in patient with tight hamstring, low back pain and in patient who have painful or limited straight leg raise⁹. There is another physiotherapy technique described by Mulligan – The traction straight leg raise (TSLR), which improves the mobility in patients with leg pain or hamstring tightness¹².

There are various methods available for the treatment of tight hamstring and to improve flexibility, but there is limited research work which compare mulligan TSLR and mulligan BLR. Therefore there is need to check the effectiveness of these two techniques in sewing machine operators

METHODOLOGY

A randomized controlled trial study of 40 subjects using simple random sampling and allocation with chit method was done. 40 small chits were used with 20 pieces having the words group A and the treatment allocated to them was mulligan bent leg raise (BLR), 20 pieces having the words as group B and the treatment allocated to them was mulligan traction straight leg raise (TSLR).

As the study includes human subjects, ethical clearance is obtained from ethical committee of K.T.G. College of physiotherapy and KTG Hospital, Bangalore as per the ethical guidelines for Bio-Medical research on human subjects, 2000 ICMR, New Delhi. The subjects were treated for 4 weeks with 3 session /week. Informed written consent was taken from each subject. Sewing machine operators with age between 40 to 60 years, hamstring tightness with nonspecific low back pain, having sitting duration of 6 to 8 hours and lack of active knee extension test more than 20° were included in this study. Those having Any musculoskeletal deformities of lower extremity, History of any recent abdominal and back surgeries, Low back pain with specific pathology, Pregnancy and Psychologically imbalanced patients were excluded from the study. The participants were assessed for hamstring tightness using Active knee extension test. Outcome measure of BSSR and ODI were taken for each participant pre and post study.

The participants in group A, enlisted in the Mulligan BLR group, were instructed to lie supine at the edge of the plinth with hip and knee in flexion and heel off the plinth. Patient holds the plinth from one side and places the hand of opposite side under his head and neck. In walk stance position with Shoulder of inner hand is placed under the popliteal fossa, Therapist grasps the lower end of thigh (very close to the popliteal fossa) with both hands. Longitudinal traction was applied along the long axis of femur; participant was asked to push the investigator's shoulder with his or her leg

followed by voluntary relaxation. Therapist then takes the hip into the full flexion until first

resistance felt. Hold the end position for about 30 seconds. At this point of relaxation, the bent knee was pushed up as far as possible in the direction of the shoulder on same side in pain free range. This stretch was sustained for 7 seconds followed by 5 seconds of relaxation. This procedure was Repeated three times. If the pain or restriction eased, the hip can be taken further into flexion. it should be ensured that there was no pain during the procedure; if the patient experiences pain then the direction of the leg raise is altered medially or laterally. The contra lateral leg is to be kept relaxed and allowed to moves as it goes.



BLR

The participants in group B, enlisted in the Mulligan TSLR group, were instructed to lie supine with their arms by their sides and a single pillow under head. Therapist hold the distal leg (just proximal to both the malleoli) and reinforce this grip with his or her elbow of other hand. Therapist was applying longitudinal traction along the long axis of the leg and then raises patients leg off the bed to a position just short of painful range. Traction is then sustained and leg is raised as far as possible provided there is no pain. Hold the new available end range for 10 seconds, do not release the traction till the leg returns to starting position repeat. 3 times (only if it is pain free and if the therapist is able to increase the range of motion).



TSLR

Outcome measurements (BSSR and ODI) were taken at the beginning and after 4 weeks of study. the difference of pre and post test values were compared between the group using statistical analysis.

OUTCOME MEASUREMENT

1. Baseline outcome measure: AKET

The AKE (Active knee extension) was performed using an experimental apparatus designed specifically for investigating hamstring tightness. AKE was done on a rectangular wooden frame that was attached to an examination table. Participants was instructed to lay supine on the table, facing the wooden frame, tested limb was flexed until the thigh touches the wooden frame, being at 90° with the table. The contra lateral limb was fully extended and the knee flexed at 90°. A standard universal goniometer was placed over the lateral femoral condyle with one arm aligned along the thigh in direction to the greater trochanter and the other arm aligned over the leg in direction to the lateral malleolus. From this position, subjects were instructed to extend the knee until they feel a strong resistance, hold this final position for 2-3 sec, then taking the goniometric reading. The result was recorded and corresponded to the amplitude, in degrees, of the knee extension movement, starting from the initial test position (knee flexed at 90° which corresponded to the goniometric 0°).



AKET

2. BSSR

The back-saver sit and reach test was measured using a sit and reach box placed against a wall.

Before starting the procedure, each subject was asked to remove foot-ware. And to sat down on the floor with leg stretched out straight ahead at the test apparatus. One leg was fully extended with his soles of the foot flat against the sit and reach box and the other knee was flexed with the foot flat on the floor. When patient adapt this position, with the palm facing downward and hands on the top of each other; then they were asked to reach forward along the measuring line as far as possible. When patient was performing this movements, we ensured that the hands was remain at the same level, not one reaching further forward than other. We record the distance when reached out and held that position for one -two seconds.at the starting of procedure we instruct the patient for not to perform jerky movement during procedure. we record the score to the nearest centimetre as the distance reach by the hand. After one side had been measured, the subject switched the position of their legs



BSSR

3. ODI

Oswestry Disability questionnaire was given to the patient and all the 10 components of the questionnaire was explained. The purpose of the questionnaire was also explained to patient i.e. the questionnaire has been designed to give us information as to how much your back or leg pain is affecting your ability to manage everyday life and we realise that you may consider the two or more statements in any one section

apply but please just shade out one spot that indicates the statement which most clearly describe problem.

RESULTS

Data was analysed using the SPSS 21.0 software. the level of significance was kept at 5%.all outcome measures were tested for normal distribution. Wilcoxon Signed Rank test was used for within group analysis, whereas unpaired t test was used for analysis between the groups.

Table-1: Range, mean and SD of age of the sewing machine operators with hamstring tightness and low back pain in both the groups.

Sr.no	Variable	Group-A: Mulligan with BLR		Group-B: Mulligan with TSLR		Unpaired t-test
		Range	Mean ± SD	Range	Mean ± SD	
1	Age in years	40-50	48.05±4.62	40-54	47.12±4.38	T=0.896, p>0.05, NS

NS-Not significant. ie. p>0.05.

The table 1 presents the outcomes of age in years of the sewing machine operators with hamstring tightness and low back pain in both the groups. In group-A, the subjects were ranging within the age of 40-50 with mean and SD of 48.05±4.62. In group-B, the subjects were ranging within the age of

40-54 with mean and SD of 47.12±4.38. The unpaired t-test was carried to compare the means, which was found to be not significant at 5% level (i.e., p>0.05). It revealed that the baseline characteristic of age was similar in both the groups.

Table-2: Distribution of sewing machine operators with hamstring tightness and low back pain according to gender in both groups.

Sr.no	Gender	Group	
		Group-A: Mulligan with BLR	Group-B: Mulligan with TSLR
1	Male	11(55.0%)	9(45.0%)
2	Female	9(45.0 %)	11(55.0%)
		Chi-Square value=0.406 df=1, p>0.05,NS	

NS-Not significant. ie.,p>0.05.

The above table-2 shows the proportion of sewing machine operators with hamstring tightness and low back pain according to gender. In group-A, the subjects with Sewing machine operators with hamstring tightness and low back pain 11(55.0%) of them were males and 9(45.0 %) of them were females. In group-B, more or less same gender proportion of 9(45.0%) and

11(55.0%) of subjects was found. The Chi-square test was worked out and it was found to be not significant at 5% level (p>0.05). It evidenced the baseline characteristic of gender is homogeneous in both the groups. The following pie diagrams depicted the proportion of sewing machine operators with hamstring tightness and low back pain according to gender.

Table-3: Range, mean and SD of outcome measures of sewing machine operators with hamstring tightness and low back pain in group-A

Sr.no	Outcome measures	Group-A : Mulligan with BLR				Paired t-test/ Wilcoxon test	p-value
		Pre test		Post test			
		Range	Mean ±SD	Range	Mean ±SD		
1	BSSR(Right)	1.5-5.0	2.97±1.08	3.5-8.0	5.50 ± 1.27	t=23.911*	p<0.001
2	BSSR(left)	1.5-4.5	3.05±0.84	3-7.5	5.55±0.84	t=22.973*	p<0.001
3	ODI	22-48	27.48±7.72	15.55-42.00	21.67±7.92	z=3.979*	P<0.001

Note; * denotes –Significant (p<0.05), z- Wilcoxon test

The above table-3 shows the pre and post test outcomes of outcome measures among the subjects with sewing machine operators with hamstring tightness and low back pain in group-A. In pre test, the BSSR (Right) was ranging within 1.5-5.0 with mean and SD of 2.97±1.08. But in post test, it was found to be increased to the range 3.5-8.0 with mean and SD of 5.50 ± 1.27. The parametric test for significance of dependent outcomes and measurable the paired t-test was carried out and it was found to be significant (p<0.001). Regarding BSSR (left) in group-A, in pre test, the scores were ranging within 1.5-4.5 with mean and SD of 3.05±0.84. But in post test, the scores were found to be increased to the range of 3.0-7.5 with mean and SD of 5.55±0.84. The parametric test for

significance of dependent outcomes and measurable the paired t- test was carried out and it was found to be significant (p<0.001) According to ODI in group-A, pre test, the scores were ranging within 22-48 with mean and SD of 27.48±7.72. But in post test, the scores were found to be decreased to the range of 15.55-42.00 with mean and SD of 21.67±7.92. The Non-parametric test for significance of dependent outcomes and ordinal the Wilcoxon test was carried out and it was found to be significant (p<0.001) It evidences the there is a significant increase in BSSR in both right and left side and significant decrease in disability (ODI) among sewing machine operators with hamstring tightness and low back pain in group-A.

Table-4: Range, mean and SD of outcome measures of sewing machine operators with hamstring tightness and low back pain in group-B

Sr.no	Outcome measures	Group-B: Mulligan with TSLR				Paired t-test/ Wilcoxon test	p-value
		Pre test		Post test			
		Range	Mean ±SD	Range	Mean ±SD		
1	BSSR(Right)	1.5-4.5	2.77±0.91	3.5-7.5	5.27 ± 1.17	t=26.049*	p<0.001
2	BSSR(left)	1.5-4.0	2.97±0.73	4-7	5.52±0.93	t=21.293*	p<0.001
3	ODI	22-46	29.80±9.02	15-42	23.10±8.62	z=3.964*	P<0.001

Note; * denotes –Significant (p<0.05), z- Wilcoxon test

The above table-4 shows the pre and post test outcomes of outcome measures among the subjects with sewing machine operators with hamstring tightness and low back pain in group-B In pre test, the BSSR (Right) was ranging within 1.5-4.5 with mean and SD of 2.77±0.91. But in post test, it was found to be increased to the range 3.5-7.5 with mean and SD of 5.27 ± 1.17. The parametric test for significance of dependent outcomes and measurable the paired t-test was carried out and it was found to be significant (p<0.001). Regarding BSSR (left) in group-B, in pre test, the scores were ranging within 1.5-4.0 with mean and SD of 2.97±0.73. But in post test, the scores were found to be increased to the range of 4-7 with mean and SD of 5.52±0.93. The parametric test for

significance of dependent outcomes and measurable the paired t- test was carried out and it was found to be significant (p<0.001) According to ODI in group-B, pre test, the scores were ranging within 22-46 with mean and SD of 29.80±9.02. But in post test, the scores were found to be decreased to the range of 15-42 with mean and SD of 23.10±8.62. The Non-parametric test for significance of dependent outcomes and ordinal the Wilcoxon test was carried out and it was found to be significant (p<0.001) It evidences the there is a significant increase in BSSR in both right and left side and significant decrease in disability (ODI) among sewing machine operators with hamstring tightness and low back pain in group-B

Table-5: Comparison of pre and posttest outcome measures of sewing machine operators with hamstring tightness and low back pain in between the groups.

Sr.no	Outcome measures	Pre test		Post test	
		Group-A (BLR)	Group-B (TSLR)	Group-A (BLR)	Group-B (TSLR)
		Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD
1	BSSR (Right)	2.97±1.08	2.77±0.91	5.50 ± 1.27	5.27 ± 1.17
2	BSSR (left)	3.05±0.84	2.97±0.73	5.55±0.84	5.52±0.93
3	ODI	27.48±7.72	29.80±9.02	21.67±7.92	23.10±8.62
Between group comparisons: Unpaired t-test/ Mann- Whitney U test		BSSR(Right): t=0.205, p>0.05, NS BSSR(Left): t=0.422 p>0.05, NS ODI: z=1.228 p>0.05, NS		BSSR(Right): t=0.659, p>0.05, NS BSSR(Left): t=0.607, p>0.05, NS ODI: z=0.0966, p>0.05, NS	

S-denotes significant (p<0.05); NS – not significant (p>0.05).

DISCUSSION

The purpose of this study was to compare the Mulligan Bent Leg raise (BLR) versus Traction Straight Leg Raise (TSLR) technique in hamstring tightness in sewing machine operators with low back pain. Hamstring tightness was measured by the goniometer with Active knee extension test for inclusion of the subject in the study. Individual flexibility of hamstring was measured by back saver sit and reach test (in inches) and disability due to low back pain was evaluated with Oswestry low back pain disability questionnaire (in %).

In the present study, a comparative experimental study design of 40 subjects who was sewing machine operators with hamstring tightness and low back pain were randomized into two groups. subjects in group A received Mulligan Bent Leg Raise Technique for 4 weeks with 3 session per week and Subjects in group B received Traction Straight LEG raise technique for 4 weeks with 3 session per week.

Range, mean and SD of age in both groups studied shows that the mean and SD of group-A and B shows that the age was similar in both groups. (Table no. 1). The gender distribution of the subjects studied shows that no statistically significant difference in subjects taken between group A and group B. p>0.05 (Table no. 2)

In group A, the mean SD (2.97±1.08) for pre intervention BSSR(Right) was found to be increased in post intervention BSSR (5.50 ± 1.27) in the same way the mean SD (5.55±0.84) for post intervention BSSR (left) was found to be greater as compared to the mean SD for pre intervention

(3.05±0.84.) On the other hand, the mean SD (21.67±7.92.) post intervention for ODI was found to be less than the mean SD for pre intervention (27.48±7.72). this shows that there is a significant increase in BSSR (p<0.001) in both right and left side and significant decrease in disability in ODI (p<0.001) (Table no. 3)

in group B, pre intervention ,the BSSR(Right) with mean and SD of 2.77±0.91 was found to be increased after post intervention measurement with mean and SD of 5.27 ± 1.17 similarly pre intervention ,the BSSR (left) with mean and SD of 2.97±0.73) were found to be increased with mean and SD of 5.52±0.93. on the other hand, mean and SD (23.10±8.62) post intervention for ODI was found to be less than the mean SD for pre intervention (29.80±9.02.). this statistical analysis reveals that there is decreased in the disability score and significantly increase In both right and left side BSSR ranges. (Table-4)

after comparing the pre and post test outcome measure in both groups i.e BSSR and ODI it revealed there is significantly improved outcome measured ranges in same way in both groups. Thus the analysis of the present study shows that both the interventions of Mulligans bent leg raise and Traction straight leg raise were found to be individually effective in treating sewing machine operators with hamstring tightness and low back pain in increasing BSSR in both right and left side and decreasing the disability. However while compared the post test outcomes in between the groups,

there was no much difference in between the groups.

In the present study the application of mulligans BLR technique showed improvement in the flexibility of both right and left hamstring and reduction in disability due to low back pain this may be due to Various research over Mulligan's BLR method suggest it as contract relax method where contract relax cycles applied to hamstrings provide peripheral somatic input to the contracting muscle²². The study conducted by by gajendra kumar patel regarding the effectiveness of mulligan bent leg raising compared to slump stretching in the treatment of patient with low back pain showed that MBLR technique is significantly reduce pain and improve ROM¹¹.

Other study conducted by the Tejashree Bohir et.al Evaluated immediate effect of Mulligan bent leg raise technique versus myofascial release on hamstring tightness, in young adults. The study was done on a 40 healthy subject which are divided into two groups i.e Mulligan BLR group (20) and control group (20). The outcome was measure she used the back saver sit and reach test. The study concluded that the single intervention of Mulligan BLR and self MFR techniques are equally effective in improving hamstring flexibility¹.

muscles rather than changes due to stretch tolerance be directly related to inhibition of the hamstring muscles rather than changes due to stretch tolerance.²³

The findings of the present study regarding the effectiveness of Mulligans TSLR are supported by other studies. The study conducted by Basant Kumar Singh et.in 2016 conducted to compare the effect of dynamic soft tissue mobilisation and Mulligan traction straight leg raise in increasing hamstrings flexibility. Showed that Mulligan's traction straight leg raise and Dynamic Soft Tissue Mobilization improved active range of knee and passive straight leg raise range of motion in normal individuals. Study was conducted on 60 healthy asymptomatic Students with

hamstrings tightness age between 17 to 30 years. Active knee extension and passive SLR are used as an outcome measure²⁴.

CONCLUSION

The present study concludes that both the interventions in group-A (BLR) and group-B (TSLR) were found to be individually effective in treating sewing machine operators with hamstring tightness and low back pain in increasing BSSR in both right and left side and decreasing the disability. But, while compared the post test outcomes in between the groups, there was no much difference in between the groups. It is clinically recommended to consider both Mulligans BLR and TSLR techniques for hamstring tightness in sewing machine operators with low back pain.

Limitations Of The Study

1. Subjects with small range group between 40-60 years of age were considered for study thus, results cannot be generalized to individual age.
2. Follow up was not done after 4 weeks of intervention therefore long term effects were not known.
3. Relatively Small sample size taken
4. Gender wise comparison between effectiveness of Mulligans BLR over TSLR has not be done

Recommendation For Future Research

Follow up after 6 weeks of intervention can be used to find further effectiveness of the techniques on subjects.

Further study can be done on large number of groups.

Further study is needed to compare the effect of other techniques or combination therapies except Mulligans BLR and TSLR

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