

Comparative Effects of Mulligan's Two Leg Rotation Technique and Muscle Energy Technique on Hamstring Flexibility

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ABSTRACT

Aim: To compare the effects of the Mulligan two-leg rotation technique (TLR) and the Muscle Energy Technique (MET) on hamstring flexibility.

Methods: The Double-blinded randomized controlled trial was conducted among 108 subjects including both males and females with the age group of 18-35 years and on examination having hamstring tightness measured by an Active Knee Extension (AKE) Test. Group A was given Mulligan's Two leg rotation (TLR) technique with routine physiotherapy, and Group B was given Muscle energy technique (MET) with routine physiotherapy. A total of 12 sessions were given to both groups, 3 sessions per week. Data was calculated at baseline and after every 6th session.

Results: Group A had 50% males and females and Group B had 53.7% males and 46.3% females. There was a significant improvement in the flexibility of the hamstring with the application of Mulligan-TLR and MET. However, the increase in AKE range of motion was higher in MET compared to the Mulligan TLR group. Mann-Whitney U test was used to compare the mean between the two groups and shows a significant difference in values of Numeric Pain Rating scale (NPRS) ($P < 0.005$) and AKE ($P < 0.005$) after 12 sessions.

Conclusion: The study demonstrated that both techniques are effective in improving hamstrings flexibility but better results are shown with MET. Therefore, it is concluded that both can be administered in clinical practice for improving hamstring flexibility.

Keywords: Knee, Low back pain, Pain

INTRODUCTION

Low back pain is defined as pain, stiffness, or muscle tension that is localized under the costal margin and beyond the inferior gluteal folds that can be with or without sciatica, and it is termed as chronic when it remains for more than 12 weeks¹. Low back pain is classified as acute, sub-acute, and chronic low back pain. Further low back pain is categorized into Specific and Non-specific types of low back pain (NSLBP). 85% of the cases are known to be of non-specific cause².

Muscle functions compromised due to pain can subsequently lead to a change in muscle structure. Certainly, some studies support the evidence that structural changes are strongly related to the presence of NSLBP, though others find no link between the occurrence of NSLBP and structural changes in paraspinal muscles³.

Muscle tightness is considered to be a major limiting factor for optimum performance, including the daily activities of a person⁴. The capability of a person to move efficiently is all related to his flexibility. Flexibility is a significant constituent of physical training programs used in addition to strengthening and endurance of muscle. A decrease in flexibility of a muscle not only diminishes the level of function due to overuse but can also cause harm to the musculoskeletal system. Such impairments mostly occur in multi-joint muscles which have great functional activity and a very high ratio of fast-twitch muscle fibers⁵.

The hamstring muscles are a group of muscles and are mainly involved in giving stability to the hip and knee joint throughout walking. Hamstring muscle has a propensity to get short even under ordinary conditions and is also associated with low back pain and dysfunction of the lumbar spine. Sustaining the flexibility of the hamstring muscle is vital for the general and athletic population and of most significant for health care professionals⁶.

Clinically, there are many methods for indirectly measuring hamstring muscle length by measuring hip's range through many

special tests like Passive knee extension, Active knee extension test (AKE), Straight leg raise test, and by taking Popliteal angle. Above all AKE test has been suggested to measure hamstrings muscle extensibility with high reliability because of very minimal motion occurring at the lumbar spine and pelvis. It is also significant to highlight that the AKE test has a high inter tester and intra tester correlation that is (ICC, 0.990)⁷. Failure to achieve greater than 160 degrees of knee extension while keeping the 90 degrees of hip flexion is defined as tightness for the hamstring muscle. The regular goniometer is a reasonable and accessible measurement tool used to measure the AKE⁸.

There are numerous studies on Mulligan's techniques that have shown to be effective in reducing hamstring tightness. Mulligan two-leg rotation (TLR) is a pain-free technique that can be practiced in any patient having hamstring tightness, complaining of low back pain, and with reduced straight leg raise. It can be more useful in patients with bilateral restrictions of straight leg raising. It is assumed for the opening of the lateral intervertebral foramen helps in the moving of neural structure⁹.

Several stretching techniques have been implemented to increase hamstring flexibility. The post isometric relaxation (PIR) technique of Muscle energy technique (MET) is used by many physical therapists. In the PIR technique, isometric contraction helps decrease the agonist's muscle tone. This follows the stretch receptors in the tendon of the agonist muscle known as Golgi tendon organs. Moreover, MET and its associated PIR techniques have shown better effects in increasing the flexibility of the short muscles¹⁰.

The objective of the study was to compare the effectiveness of Mulligan's TLR and MET in patients with chronic low back pain.

METHODS

After permission from Ethical Review Board, this double-blinded randomized controlled trial was conducted in the outpatient Physiotherapy department of Bakhtawar Amin Trust Teaching Hospital of Multan. Total 108 subjects following inclusion criteria including both males and females with the age group of 18-35 years having NSLBP for more than 3 months and on examination

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having hamstring tightness were included in the study. Baseline demographic and clinical features of all the patients were documented.

After taking written informed consent, patients meeting the inclusion criteria were included in the study. Subjects were screened for hamstring tightness by a trained physiotherapist. Patients were randomly allocated in two equal groups according to computer generated random number table. Each participant was assigned random number. Group A received the Mulligan's two leg rotation technique with routine physiotherapy and group B received the muscle energy technique with routine physiotherapy with total treatment time duration of approximately 40 minutes. Total 12 sessions were given to both groups, 3 sessions per week. Data was calculated at base line and after every 6th session. Hamstring tightness was measured by AKE test and pain intensity was measured by Numeric Pain Rating Scale

For measuring AKE angle patient lies on his back on the examination table. The hips and knees were aligned at an angle of 90 degrees. The fulcrum of the goniometer was placed over the femur lateral condyle, the stationary arm was placed along the femur, and the moving arm was placed along the lower leg using lateral malleolus. The patient was instructed to extend the lower leg as far as strong resistance to the movement feels. A reduction in AKE of more than 30 degrees is considered a hamstring tightness. Three repetitions were performed, and the average of these readings was used as the final result⁸.

Treatment Groups: Group A: Mulligan Two Leg Rotation Technique, the therapist stands at the limited hamstrings flexibility side of the patient. After stabilizing the patient's leg was fully flexed and slowly taken to the side of the limited hamstring muscle flexibility. When the limit was reached, the position was sustained for 30 seconds with overpressure applied by the therapist, and then the legs were lowered to the plinth. Three repetitions were repeated with 1 minute rest time between each stretch¹¹.

Group B: Muscle Energy Technique. Patient was instructed to lie in a supine position. The therapist passively flexed the treated leg at the hip and the patient knee was straightened on the therapist's shoulder until the primary resistance was felt. The patient was instructed to apply pressure for 7-10 seconds on the therapist's shoulder against resistance by using no more than 25% of their strength during isometric contractions. The contraction period was followed by a relaxation period and then the therapist passively straightened the knee towards its new barrier and held it for 30 seconds. The procedure was repeated 4 times with a 10-second rest interval between them¹².

Table 1: Comparison of Demographic Characteristics of Participants between Groups. TLR: Two Leg Rotation, MET: Muscle Energy Technique

Variable		Group A (Mulligan TLR)				Group B (Muscle Energy Technique)			
		Mean ± SD	Range	Freq.	%	Mean ± SD	Range	Freq.	%
Age of the participant		28.26 ±3.953	16			27.35±5.014	17		
Gender	Male			27	50			29	53.7
	Female			27	50			25	46.3
	Up to 8 hours			30	55.6			26	48.1
	More than 8 hours			24	44.4			28	51.9

Table 2: Comparison of Pain and AKE at Baseline, 2nd Week and 4th Week of Participants between Groups

Assessment	Group A (Mulligan TLR) Group B (Muscle Energy Technique)	Mean	Std. Deviation	Mean Rank	P Value
NPRS at Baseline	Group A	6.02	0.68	55.30	0.764*
	Group B	5.98	0.59	53.70	
NPRS at 2ndweek	Group A	4.96	0.64	54.46	0.989*
	Group B	4.96	0.58	54.54	
NPRS at 4th week	Group A	3.75	0.58	65.31	0.000*
	Group B	3.18	0.72	43.69	
AKE at Baseline	Group A	52.40	1.98	51.64	0.334*
	Group B	52.81	1.95	57.36	
AKE at 2nd week	Group A	44.16	1.24	65.48	0.000*
	Group B	42.51	2.08	43.52	
AKE at 4th week	Group A	30.46	1.75	73.78	0.000*
	Group B	27.81	1.71	35.22	

NPRS: Numeric Pain Rating Scale, AKE: Active Knee Extension, TLR: Two Leg Rotation, MET: Muscle Energy Technique

After the application of the technique supervised exercises treatment protocol was done which include static back extensors exercise, static, pelvic bridging, pelvic rolling, Cat-Camel was done¹³. A home plan was given to perform the same supervised exercise plan with the same repetition twice a day.

OpenEpi software was used to determine the study's sample size by keeping the power of the study equal to 80% and the level of significance equal to 5%. The sample size was 54 in each group. However, each group includes an increased number of patients, in the case of dropout.

Data was analyzed by SPSS 21.0. Normality distribution of data was analyzed by Kolmogorov-Smirnov^a and Shapiro-Wilk test. The tests of normality showed that the data is non-parametric. Mann-Whitney U test was used to compare the mean of AKE and NPRS between the two groups at baseline and follow-up periods. Percentages and frequency table was used for categorical variables. Mean ± SD was used for the numerical variable. Criteria of significance i.e. p-value ≤ 0.05*.

RESULTS

A total of 108 individuals 54 in each group were included in the study. The descriptive statistics of age showed that mean and standard deviation were found to be 28.26±3.95 for Group A and 27.35±5.01 for Group B. There were 50% male and females in group A and 53.7% males and 46.3% females in group B. Working hours showed that there were 55.6% subjects working up to 8 hours and 44.4% subjects working more than 8 hours in group A and while those of 48.1% subjects working up to 8 hours and 51.9% working more than 8hours in Group B (Table 1).

The results regarding the comparison of pain intensity by Mann-Whitney U test at baseline showed that mean and standard deviation were 6.01±0.68 and 5.98±0.59 in Group A and Group B while p-value was 0.764*, at 2nd-week pain intensity found to be 4.96±0.64 and 4.96±0.58 with p-value 0.989* and 3.75±0.58 and 3.18±0.72 and 43.69 in Group A and Group B, p-value 0.000*. And values for hamstring flexibility at baseline showed that mean and standard deviation were found to be 52.40±1.98 and 52.81±1.95 in Group A and Group B with p-value 0.334*, at 2nd week mean and standard deviation were found to be 44.16±1.24 and 42.51±2.08 in Group A and Group B with p-value 0.000*. And at the 4th Week mean and standard deviation were found to be 30.46±1.75 and 27.81±1.71 in Group A and Group B with p-value 0.000* at 4th week (Table 2).

DISCUSSION

This study evident effective results that show that there was a substantial variance found in the mean of pain and hamstrings flexibility between the groups. This study was undertaken to examine the influence of Mulligan TLR and MET for pain and hamstrings flexibility in patients with chronic NSLBP. The results of this study show that both techniques were effective in improving the AKE score. But the subjects who received MET were found out to be more effective in the improvement of hamstrings flexibility at the end of 12th session. Whereas pain score was found to be equally improved in both groups.

Several studies were conducted in the past to find the best physical therapy management for reducing hamstring stiffness and pain in patients with low back pain. In most cases, changes in lifestyle and daily activities can cause muscle strain and back pain¹⁴.

The tightness in hamstrings starts at an age of 5-6 years and gets its peak at an age of 25 or more when a person is occupationally involved. The results of our study can be interrelated with the reference mentioned since in our study's age of subjects is 18 to 35 years following the inclusion criteria with the mean age score of 28.26 for Group A and 27.35 for Group B¹¹. Stiffness can be gender-related and was significantly decreased in females compared to males with a tight hamstring¹⁵.

Mulligan TLR is a technique that can be practiced in patients having tight hamstring, low back pain, and reduced straight leg raise¹⁶. It may help in increasing the length of the posterior femur due to a variation in the acceptable range of muscle extension, reduction in stiffness¹⁷.

Phansopkar et al. reported that TLR can lessen the sensory pain receptor load, decrease symptoms, and increase range of motion. This clinical trial was led among 40 subjects including 22 males and 18 females between the age of 18 to 35 years and having acute NSLBP. Intra-group evaluation for all the outcome variables showed statistical significance on the 7th-day post-intervention ($p < 0.01$)¹¹.

Lee H et al. compared the Mulligan TLR technique with the static stretching technique among 27 patients and stated that TLR has a more positive effect in decreasing pain and stiffness (18). An increase in the flexibility of the hamstring by Mulligan TLR might be due to variation in tolerance of muscle stretch, through a reduction in muscle stiffness or increases in muscle compliance, which in turn enhance the hamstrings lengthening¹⁹.

The AKE test is the most commonly used test for assessing hamstring flexibility. The mean AKE score in our current study shows that it was improved with both techniques but shows more significant results with MET which also supports the results of a study by Ahmed et. al in which the MET group means score for AKE was 106.10 ± 1.91 before treatment and 102.3 ± 1.49 post-treatment and had extremely significant ($P < 0.001$) gains in AKE after 8 days of post stretching exercises related to another group of static stretching (20). The high reliability and effectiveness of an AKE test were also described by Gajdosik and Lusin the AKE to be more consistent in assessing the hamstring tightness²¹.

Several stretching techniques have been implemented to increase hamstring flexibility. MET is a technique used by many physical therapists. There are two types of METs named PIR and reciprocal inhibition. Contraction and relaxation methods in the PIR technique aids in the lengthening of short hamstrings. In the PIR technique, isometric contraction occurring in the agonist's muscle helps inhibit antagonist muscle, known as reciprocal inhibition. MET helps in lengthening of tight or spastic muscle, strengthening weak muscles and, helps in mobilizing a joint with limited mobility²².

As suggested by many studies, stretching exercises should improve mobility²³. Selkow et al. also stated the efficiency of MET for improving hamstring muscle (24). Further, some studies described the pain-relieving or analgesic effect with MET²⁵. MET

compared with dynamic stretching shows that both were helpful in increasing hamstring flexibility but the enhancement in MET ($P < 0.01$) was superior to that dynamic stretching ($P < 0.02$)²³.

The improvement observed in group B treated with MET can also be attributed to the effect of isometric contraction of connective tissue. For improving tissue extensibility there should be a combination of contraction and stretches which improve the viscoelasticity of the tissue. This technique improves range of motion and muscle stiffness with a neurophysiological and biomechanical mechanism in muscles²⁶ used on the literature review and the results of our study, it can be clinically implicated that the most effective technique for increasing the hamstring flexibility is MET. To inhibit muscle from getting stiff it is suggested to regularly stretch the hamstring muscles. The application of MET often disturbs the patient because of their low level of pain threshold, the patient who received Mulligan's TLR technique has fewer complaints of pain and discomfort. The reason can be because of the lesser force of contraction. Hence TLR can be given to patients with a low level of pain threshold to stretch. The outcomes and results of this study show substantial increases in the hamstring flexibility with MET. The primary tool used was the AKE test. The p-value was set to less than 0.05 and the result exhibited 0.00 proving a significant enhancement in the flexibility of hamstrings after an intervention.

The limitations of the study were that only subjects with chronic NSLBP were a part of the study, further suggesting to do studies on subjects with acute and sub-acute NSLBP pain due to hamstring tightness and with follow-up for a longer duration so that the long-term benefits can be assessed for both treatment groups.

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