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# Effect of mulligan bent leg raise technique and mulligan adductor stretch on gait parameters in stroke patients

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**Abstract**

**Background:** Mulligan Bent Leg raise Technique (BLR) and Mulligan Adductor Stretch are manual therapy concepts. BLR is usually indicated when there is tightness of hamstring muscle, sciatica and low back pain and mulligan adductor stretch is indicated in patients having tightness of adductor muscles and reduced range of hip abduction. In sub-acute and chronic stroke due to tightness and spasticity the gait is usually impaired. Hence, the study is carried out to evaluate its effects.

**Materials and Methods:** 20 participants were included. All the participants were given both the Mulligan stretches. They were asked to walk on leveled ground and their pre - post stride length, step length and cadence were measured.

**Result:** Effect of Mulligan Bent Leg Raise Technique and Mulligan Adductor stretch was highly significant on gait parameters in stroke patients.

**Conclusion:** Effect of Mulligan Bent Leg Raise Technique and Mulligan Adductor stretch was highly effective on gait parameters in stroke patients.

**Keywords:** mulligan bent leg raise technique, mulligan adductor stretch, stride length, step length, cadence

## Introduction

Stroke is typically characterized as a neurological deficit recognized by an acute focal injury of the central nervous system (CNS), including cerebral infarction, intra-cerebral hemorrhage (ICH), and subarachnoid hemorrhage (SAH), and is a major cause of disability and fatality worldwide. Walking dysfunction is a major problem for many subjects affected by stroke [1], and it causes difficulties in performing daily activities. Improving walking, with respect to safety and speed, is a major goal for stroke subjects in rehabilitation. [2]Stroke is one of the major causes of fatality in India. The estimated incidence rate of stroke ranges from 84-262/100,000 in rural and 334-424/100,000 in urban areas. The epidemiological rate is 119-145/100,000 based on the current population based studies. In humans, bipedal locomotion is a motor task where the control system, in each step, needs to support body weight, provide forward and lateral stability and continue further progression[3]. The body support during gait is mainly provided by hip and knee extensors, hip abductors and plantar flexors. Ankle dorsi flexors, rectus femoris hip flexors and adductors except adductor magnus accelerate the ipsilateral leg in early swing [2].

Gait is normal human locomotion. The alternating movements of the lower extremities essentially support the human body and along with it there is movement of the head, arms and trunk. During one gait cycle, each extremity passes through two phases: A stance phase, where some part of the foot is in contact with the floor, which consists of 60% of gait cycle, and a swing phase when the foot is not in contact with the floor, which makes up remaining 40% [4].

Stance phase is divided into sub-phases by a number of events that mark the start and end of the sub-phases. Events of stance phase are: In normal gait, the heel is the point of contact, and the event is referred to as heel contact or heel strike. Foot flat is the first instance during when foot is flat on the ground. Mid-stance is the phase in which the bodyweight is directly on the supporting lower extremity which is usually about 30% of the gait cycle. Heel–off is the point at which the heel of the reference extremity leaves the ground, usually about 40% of the gait cycle. Toe-off is immediate at which the toe leaves the ground, which is usually about 60% of the gait cycle. Swing phase consist of phases in which early swing phase begins once the toe leaves the ground and continues until mid-swing, or the point at which extremity is directly under the body, this phase is also referred to as initial swing, or the acceleration phase. Mid-swing occurs approximately when the extremity passes directly beneath the body or from the end of acceleration to the beginning of deceleration. Late swing occurs after mid-swing when the limb is decelerating and preparation for heel strike. It is also known as terminal swing, or the deceleration phase [5].

In stroke patients, decrease in gait speed and asymmetrical gait patterns are commonly observed. Gait asymmetries are often characterized by decreased duration of single leg stance

on the involved limb; differences in step length, primarily decreased step length of the unimpaired limb versus the impaired limb and stride lengths are significantly reduced in stroke patients as compared to normal individual [6]. It is also important that individual's post stroke could have various kinematic variation during swing phase such as a reduced knee flexion (e.g. caused by hypertonic knee extensors or reduced leg velocity), higher hip abduction, lower dorsi-flexion, and hip hiking or circumduction that could lead to an increase swing time [7].

Reduced foot clearance along with tightness or hyper-tonicity in the swing phase is mainly observed in post- stroke patients, which could be compensated by a pelvic hiking, circumduction or vaulting. Insufficient hip flexion and lack of knee flexion, with or without genu-recurvatum, lead to classic circumduction. Weakness of the flexor muscles, spasticity of the extensor muscles, and a synergistic extension motor pattern may be the main causes of gait disturbance [8].

The gait is characterized by decreased velocity and cadence, and increased gait cycle and double limb support. The patients' hemiplegic side, when compared with their contra-lateral side, utilized a lesser amount of time in stance and more amount of time in swing phase [9].

Individuals having stroke usually suffer from spasticity or hypertonicity. In hypertonicity the individuals usually have altered resting length of the affected muscle group and hence the capacity of the muscle developing maximum tension is also reduced [10]. So in order to restore the optimum length of the muscle stretching is done [11]. Stretching exercises were developed to manage hypertonicity, including passive and active stretching, positioning, and isotonic and isokinetic stretching. The effect of stretching depends on tension applied to the soft tissue, duration, repetition in session, and regularity [12]. Various types of stretching like proprioceptive neuromuscular facilitation, static stretching are considered very effective as they help to increase range of motion due to neurophysiologic mechanism mediated by muscle spindle fibers and Golgi tendon bodies [13].

The Mulligan Bent Leg Raise (BLR) technique is a technique in which there is improvement in the range of straight leg raise (SLR), decrease tightness; normalize the tone of the hamstring muscle and in sciatica [14]. In bent leg raise technique, the patient lies at the edge of bed in supine position. Therapist stands to the affected side, in walk stance position. The end range is hold for about 20 sec. 3 sets are given and patient is reassessed [15].

In Mulligan Adductor Stretch, patient is in supine lying with both the legs on either side of bed as in bike riding position. Two therapists will stand on either side of the patient. 3 sets are given and patient is reassessed [16].

## Material and Methodology

**Study Design:** Experimental study (Pre and Post)

**Source of Data:** Registered patients of In- patient Medicine Department of Pravara Rural Hospital and Out- patient of Neuro- Sciences Physiotherapy Department of Dr. A. P. J. Abdul Kalam College of Physiotherapy, PIMS (DU), Loni

**Type of Data:** The data was primary which was collected by the principal investigator.

**Study setting:** Department of Neuro-sciences Physiotherapy, PIMS, Loni.

**Sample size:** 20

**Target Population:** Individuals with Clinical Diagnosis of stroke

**Sampling Method:** Purposive Sampling

**Study Duration: 4 months (August 2017 - November 2017)**

### Selection Criteria

1. Males and females diagnosed with stroke who were willing to participate, scoring 40 or above on berg balance scale and were having tightness or spasticity of grade 1 or 2 on Modified Ashworth Scale in hamstring or adductor muscle were included in the study.
2. Individuals whose age was 70 or above, having history of fracture in past 6 months, recent skin infection and recent wounds were excluded from study.

### Procedure

The study received ethical approval from Institutional Ethical Committee of Dr. APJ Abdul Kalam College of Physiotherapy, Loni

The participants were screened and according to inclusion and exclusion criteria they were requested to participate in the study. The participants were briefed about nature, duration of the study and intervention being used and were explained about the intervention in the language best understood by them. They were encouraged to clarify the queries regarding the study. A written informed consent form, approved by ethical committee was taken from the participants. The demographic data was obtained and the detailed assessment was done.

The patients were assessed for tightness of the hamstring and adductor muscle and baseline parameters like step length, stride length and cadence were also calculated. The patients were explained in detail about the techniques, its advantages and disadvantages as well; if they were convinced about the whole protocol, the techniques (Mulligan Bent Leg Raise Technique and Mulligan Adductor Stretch) were given. After the session they were asked about any discomfort and pain they experienced after the techniques were applied.

Then the techniques (Mulligan Bent Leg Raise technique and Mulligan adductor Stretch) were applied for a total of 6 sessions per patients, which is 1 session per day. The technique was mainly applied on the hamstrings and adductors group of muscles. Gait parameters like step length, stride length and cadence were evaluated after the technique. And the acquired data was calculated and accordingly interpreted.

**Fig 1:** Starting position of Mulligan Bent Leg Raise Technique

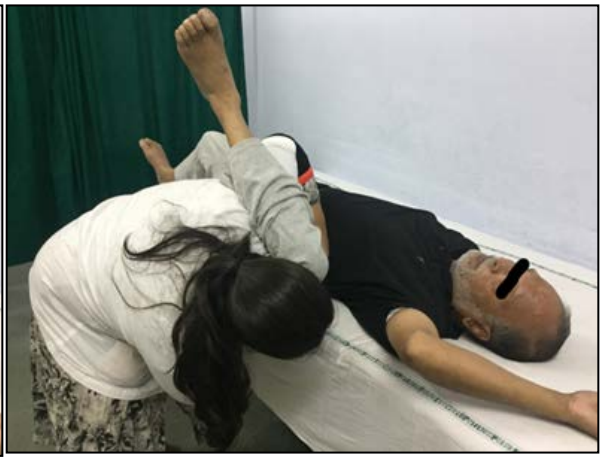

**Fig 2:** End range after applying Mulligan Bent Leg Raise Technique

**Fig 3:** Starting position of Mulligan Adductor Stretch

**Fig 4:** Mulligan adductor stretch applied at end range and the patient is asked to perform push-ups.

## Data Analysis, Interpretation and Result

**Table 1:** Data representation of gender distribution of participants

| Gender | No. of Participants |
|---|---|
| Male | 8 |
| Female | 12 |

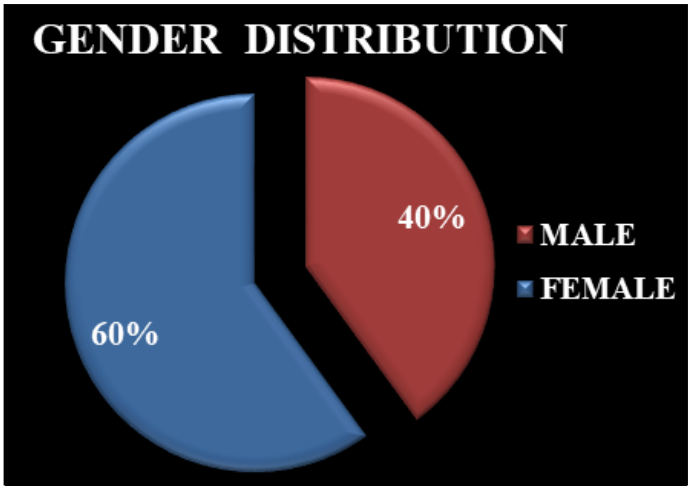


**Fig 1:** Shows demographic representation of gender

**Result no 1**: Represents no of participants, in which 12 were females and 8, were males.

**Table 2:** Data represents value of Step length of stroke patients

| Parameter | Pre (Mean ± SD) | Post (Mean ± SD) | T value | p value |
|---|---|---|---|---|
| STEP LENGTH | 23.5 ± 7.5 | 38.5 ± 8.08 | 19.94 | <0.0001, which is considered highly significant |

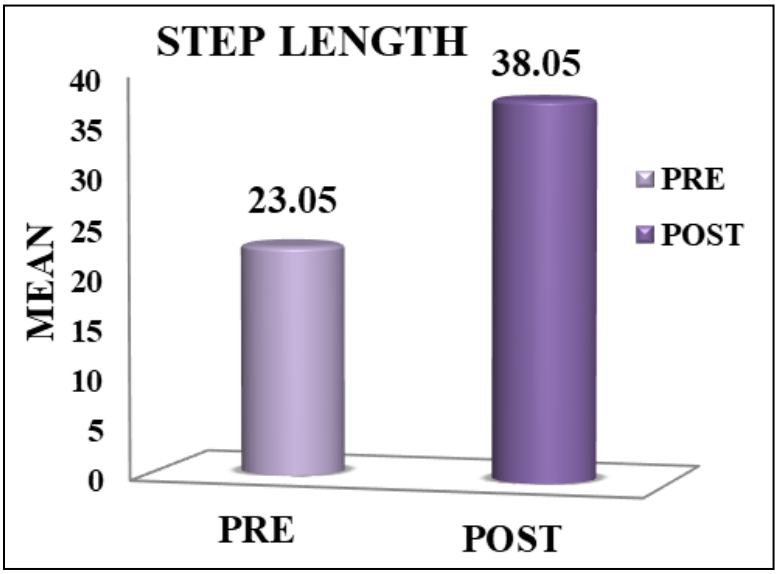


**Fig 2:** Represents pre and post Step length of stroke patients.

**Result no 2:** The above graph shows the comparison of mean value of pre and post step length, t value was 19.94 and p<0.0001 using student paired't' test within the group which shows highly significant difference post intervention.

**Table 3:** Data represents values of Stride length of stroke patients

| Parameter | Pre (Mean ± SD) | Post (Mean ± SD) | T value | p value |
|---|---|---|---|---|
| STRIDE LENGTH | 41.15 ± 16.37 | 58.33 ± 18.74 | 15.78 | <0.0001, which is considered highly significant |

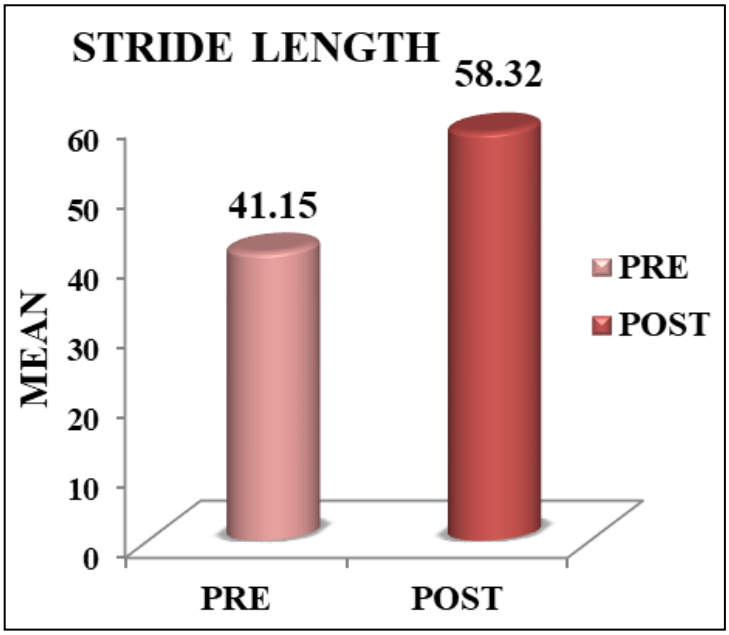


**Fig 3:** Represents pre and post stride length of stroke patients.

**Result no 3**: The above graph shows the comparison of mean value of pre and post stride length, t value was 15.78 and p<0.0001 using student paired't' test within the group which shows highly significant difference post intervention.

**Table 4:** Data representation of Stride length of stroke patients

| Parameter | Pre(Mean ±SD) | Post (Mean ± SD) | T value | p value |
|---|---|---|---|---|
| CADENCE | 49.25 ± 11.11 | 62.70 ± 12.90 | 19.60 | <0.0001, which is considered as highly significant. |

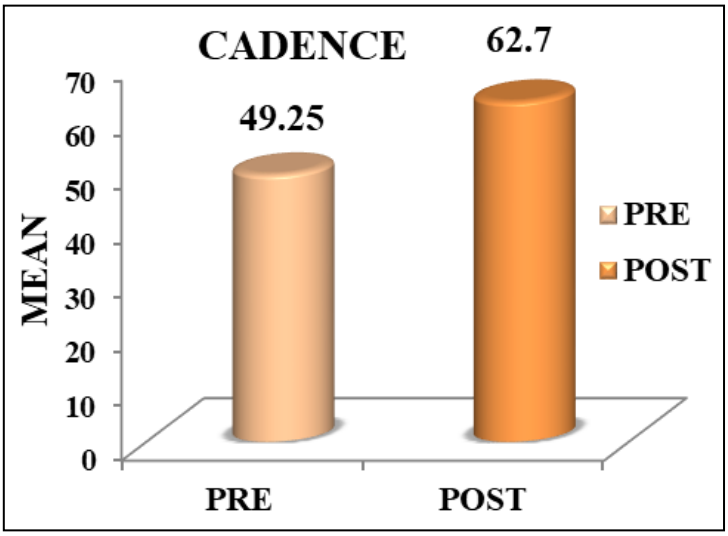


**Fig 4:** Represents pre and post cadence of stroke patients.

**Result no 4**: The above graph shows the comparison of mean value of pre and post stride length, t value was 19.60 and p<0.0001 using student paired't' test within the group which shows highly significant difference post intervention.

## Discussion

The study evaluated the effect of Mulligan Bent Leg Raise (BLR) Technique and Mulligan Adductor Stretch on gait parameters in stroke patients. The effect was measured after 6 sessions post Mulligan Bent Leg Raise Technique and Mulligan Adductor Stretch. The result of this study showed that there were highly significant changes on the gait parameters such as stride length, step length and cadence in post stroke patients.

Toby hall has suggested that immediate effect after a single intervention of Mulligan's BLR technique improves range of SLR 24 hours. This study demonstrated a significant difference of 7° in range of SLR after 24 hours following the intervention, between the BLR and placebo group. [17] So according to the study performed, the effect of mulligan bent leg raise technique and mulligan adductor stretch on gait in stroke patients showed that after using these techniques there was a reduction in spasticity of the hamstrings and the adductor muscles. This eventually led to increase in range of motion of hip flexion and hip abduction followed by significant reduction in hip hiking; knee flexion and hip abduction ranges were also increased and this eventually helped in improving the altered gait pattern in stroke patients.

Herbert Von Schroeder studied about the gait parameters following stroke and the study showed that the gait of patients with stroke was characterized by decreased velocity and cadence, and increased gait cycle and double limb support. Their affected limbs spent more time in swing and stance, and their unaffected limbs spent more time in stance and single limb support compared to controls. The patient's hemiplegic side, when compared with their contra-lateral side spent less time in stance and more time in swing phase [12]. Likewise, there was increase in gait parameters like stride length, step length and cadence. And the result showed that techniques were highly significant in increasing the gait parameters. The hemiplegic limb spent little less time in swing and more in stance and contra- lateral limb spent less time in stance phase more time in swing phase.

There are very few studies that have shown the use of mulligan bent leg raise technique and mulligan adductor stretch on gait parameters, which is indeed effective. Hence, according to the result of the study it would be beneficial to use the mulligan bent leg raise (BLR) technique and mulligan adductor stretch for the people with altered gait parameters in post stroke patients having tightness of hamstring and adductor muscles.

## Conclusion

The study concluded that Mulligan Bent Leg Raise Technique and Mulligan Adductor stretch given for 6 sessions was highly effective on gait parameters (step length, stride length, cadence) in stroke patients. As this technique helped to reduce spasticity and tightness which increased tension in the muscle fiber and along with decrease in tightness and spasticity there was increase in range of motion which eventually helped to increase the baseline parameters like stride length, step length and cadence.

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