

Effect of Mulligan Bent Leg Raise Versus PNF Agonist Contraction on Hamstrings Flexibility in Healthy Females

Varsha Venkitaraman¹, Priti Nisheet Agni²

Abstract: ***Aim & Objective:** To compare the effect of Mulligan Bent leg raise versus PNF Agonist contraction on hamstring extensibility in healthy adult females. **Methodology:** Interventional study was done on 30 healthy adult females, aged 20-30 yrs with an inclusion criteria of <75° Active Knee Extension measurement. The measurement was taken pre and post intervention bilaterally. The subjects were divided in 2 groups, first group being given Mulligan bent leg raise and second group being given Agonist Contraction technique (Proprioceptive Neuromuscular Facilitation) The treatment was given for 6 days. Pre and post AKE readings intra-group and inter-group were analyzed statistically. **Results & Conclusion:** The study concludes that Mulligan Bent Leg Raise and PNF Agonist contraction interventions both significantly improve hamstrings flexibility confirmed by appropriate statistical tests, with a P value of < 0.0001. Also inter-group comparisons showed that Mulligan BLR technique had better efficacy than PNF Agonist contraction in improving hamstrings flexibility. **Clinical Implication:** Mulligan BLR and PNF Agonist contraction can be good adjuncts for improving hamstrings flexibility.*

Keywords: Hamstrings, Bent leg raise technique, PNF Agonist contraction, Active knee extension

1. Introduction

Muscle flexibility is defined as “the ability of a muscle to lengthen allowing one joint (or more than one joint in series) to move through range of motion”. Flexibility is a physical fitness attribute and is often evaluated from the joint range of motion^[1]. Hamstrings muscle is a two-joint muscle mainly concerned with hip extension and knee flexion. Hamstrings play a crucial role in dynamically stabilizing the knee and preventing translation of tibia in daily activities such as walking running and jumping. Also, hamstrings are key decelerators. The stronger your hamstrings are, the faster you can stop, then change direction and progress. Optimum muscle flexibility is essential for optimum functioning of the muscle. Reduced hamstrings flexibility (tightness) usually occurs due to effect of age, lack of exercise, inadequate use of the muscle in its optimum length during daily activities, immobilization following surgeries or fractures, inadequate or incomplete rehabilitation, etc. Reduced muscle length will result in decreased ability of the muscle to generate tension, thus, affecting its strength and function. Hamstrings tightness, if untreated, can lead to altered biomechanics of spine, knee, ankle and foot. During the activity of lifting an object from the ground, decreased hamstrings length can impair anterior pelvic tilting in terminal ROM of lumbar flexion, thus, increasing stresses on lumbar spine and resulting in back pain. Moderate to severe hamstrings tightness results in sacral sitting and can lead to coccydynia, etc. Decreased hamstrings flexibility is a risk factor for developing patella tendinopathy, patello-femoral pain syndrome (PFPS) and hamstring strain during eccentric exercises^[2,3]. During unlocking of the knee, excessive medial hamstring tightness will cause increased tibial torsion and thus, hamper the popliteus muscle action, resulting in abnormal gait pattern i.e. inadequate knee extension during initial contact and mid-stance. At ankle joint, tight hamstrings are likely to cause Achilles tendinitis. There are various methods of stretching hamstrings^[1] such as manual/passive stretching, self-stretching, neuromuscular inhibiting techniques (e.g.- PNF),

soft tissue mobilization and manipulation, mechanical methods, Mulligan Bent Leg Raise technique, etc. Agonist contraction is one of the PNF techniques wherein “agonist” refers to the muscle opposite the range-limiting muscle. It involves concentric contraction of the agonist muscle and holding the contraction thereby inhibiting the range-limiting muscle allowing it to relax and lengthen more easily^[1]. On the other hand, the Mulligan bent leg raise technique has been described as a means of improving Straight Leg Raise range in subjects with low back pain and radiating pain. The Straight Leg Raise test has biomechanical effects on pelvis movements, on lumbo-sacral neural structures and hamstring muscle. On the other hand, the Mulligan bent leg raise technique has been described as a means of improving Straight Leg Raise range in subjects with low back pain and radiating pain. The Straight Leg Raise test has biomechanical effects on pelvis movements, on lumbo-sacral neural structures and hamstring muscle. In a comparison study between immediate effect of Mulligan Bent Leg Raise technique and passive stretching on hamstring tightness carried out in a physiotherapy college by Cheraladhan E. Sambandam, it was concluded that Mulligan technique is significantly more effective than passive stretching in healthy females with hamstring tightness^[4]. Also in a comparison study done between static stretching and proprioceptive neuromuscular facilitation (PNF) in hamstrings flexibility carried out by Karnati. V and Ali Mohammed. A, it was concluded that PNF contract-relax(agonist) stretching showed more significant improvement than static stretching^[5]. Thus, many techniques are described to improve hamstring flexibility. However, superiority of any one technique has not been documented. Also, there are very limited studies on Agonist Contraction technique of PNF as compared to other PNF techniques like hold-relax, contract-relax techniques. Hence, it was decided to compare the effects of Mulligan bent leg raise and PNF Agonist contraction as both have shown significant improvement in hamstrings-extensibility.

Volume 6 Issue 9, September 2017

www.ijsr.net

Licensed Under Creative Commons Attribution CC BY

2. Methodology

Study Design: Interventional Study.

Sample Size: 30

Sample Type: Convenience Sampling

Intervention Period: 6 days.

Outcome Measure: Active Knee Extension (AKE) Test. Subjects were divided in two groups of 15 members each. **Group 1:** Mulligan Bent Leg Raise technique. **Group 2:** PNF Agonist Contraction technique.

Inclusion Criteria: Females from the age group of 20 – 30 years with AKE of less than 75 degrees.

Exclusion Criteria: Subjects having low back pain, SI joint dysfunction, any neurological or musculoskeletal complication affecting the lower limb.

Measuring Active Knee Extension(AKE) angle^[6] The participants were made to lie in supine position. Experimental hip and knee was flexed to 90°. The thigh of the opposite leg was firmly secured with a strap to minimize the rotation of pelvis. The participants were asked to extend the knee as much as possible and the measurement was taken by a universal goniometer. 30 subjects were divided into two groups using the numbering method. Odd number subjects were allocated to Group 1 and even number

subjects were allocated to Group 2. Treatment was given for bilateral hamstring.

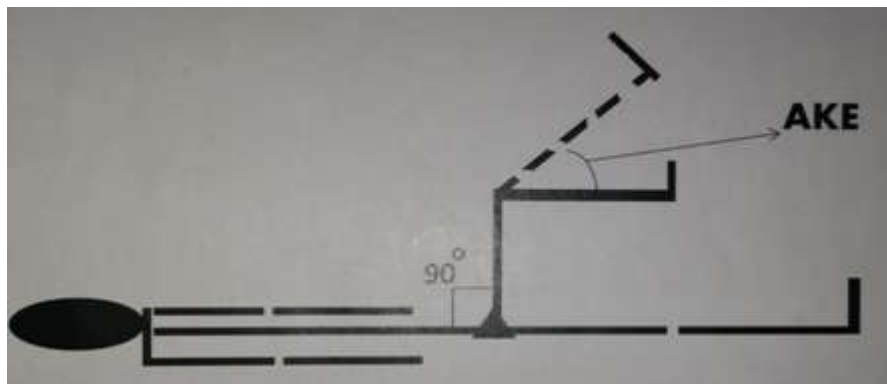
3. Intervention Protocol

Group 1: Mulligan Bent Leg Raise Technique^[7]

Subject's hip and knee is passively placed in 90° of flexion with the subject's calf resting on therapist's shoulder. Therapist takes the hip into flexion (towards same side shoulder) until first resistance is felt. Now contract-relax is applied 3-4 times by asking the subject to push down on therapist's shoulder so as to achieve hamstring contraction with hold for 5 seconds. Then the limb is taken into further hip flexion if pain-free and this end position (new range achieved) is maintained for 20 seconds. This entire process is performed thrice on each lower limb in one session.

Group 2: PNF Agonist Contraction Technique^[1]

In this case, quadriceps is the agonist muscle group and hamstring is the tight antagonist (range limiting) muscle. Subject is sitting on the plinth with legs dangling down and hands on the plinth in order to stabilize the trunk. Subject actively extends the knee of one extremity till the end of available range. At this range, subject is asked to further extend her knee against therapist's resistance and this quadriceps contraction is maintained for 10 seconds. Following this, the therapist passively further extends the knee and this new end position is maintained for 20 seconds and then relaxed. This entire process is performed thrice on each lower extremity in one session.



Mulligan Bent Leg Raise Technique



Figure 1



Figure 2

PNF Agonist Contraction Technique

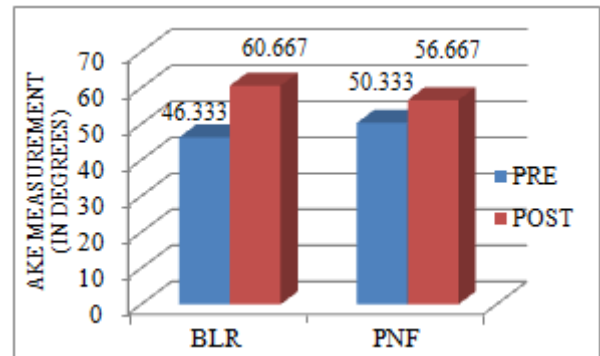


Figure 3



Figure 4

found to < 0.0001 , i.e. there was significant improvement in the AKE readings of both the groups with 6 days intervention



Graph 2: Left leg (pre and post) mean AKE readings in BLR & PNF groups.

Table 2: Mean AKE readings of Left Lower extremity.

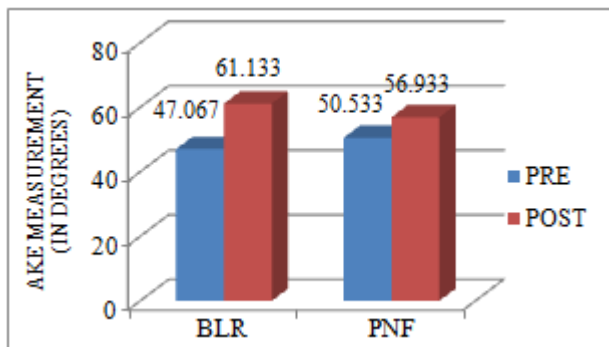
LEFT LEG	BLR	PNF
PRE	46.333	50.333
POST	60.667	56.667
P value	< 0.0001	< 0.0001

Paired t - test was performed to compare Pre and Post AKE readings of both the BLR and PNF groups. In both cases, P value was found to < 0.0001 , i.e. there was significant improvement in the AKE readings of both the groups with 6 days intervention.

4. Results and Analysis

Statistical analysis was done and the following tests were used:

- 1) Paired t test for analysis within group.
- 2) Wilcoxon matched-pairs signed-ranks test – analysis within group for data that did not follow Gaussian distribution.
- 3) Unpaired t tests for analysis between the two groups.
- 4) Mann Whitney test - analysis between two groups for data that did not follow Gaussian distribution.

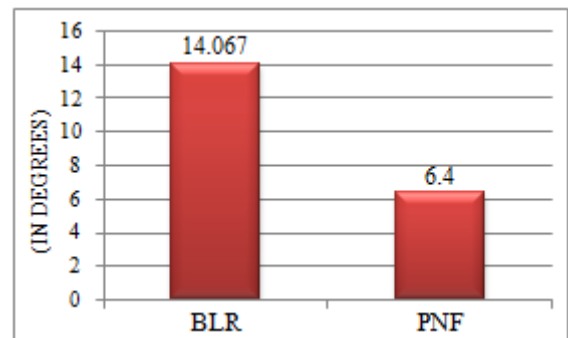


Graph 1: Right Leg (pre and post) mean AKE readings in BLR & PNF groups.

Table 1: Mean AKE readings of Right Lower extremity.

RT LEG	BLR	PNF
PRE	47.067	50.533
POST	61.133	56.933
P value	< 0.0001	< 0.0001

Paired t- test was performed to compare Pre and Post AKE readings of the BLR Group. Wilcoxon matched-pairs signed-ranks test was performed to compare Pre and Post AKE readings of the PNF Group. In both cases, P value was

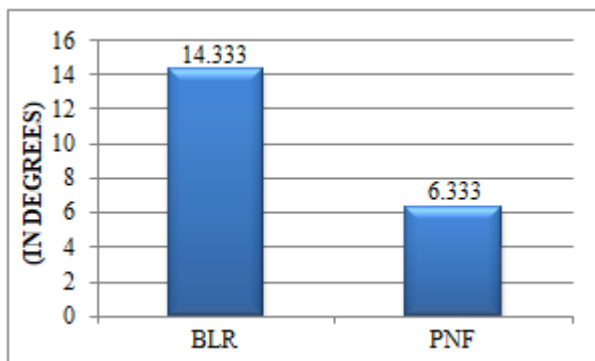


Graph 3: Improvement seen in Right lower extremity

Table 3: Inter-group comparison of Average improvement in Right Lower Extremity

Unpaired t - test	Right Leg
BLR Improvement	14.067
PNF Improvement	6.4
P value	< 0.0001

P value is < 0.0001 , which is considered extremely significant. This shows that improvement gained using Mulligan BLR technique was significantly more than that gained using PNF technique.



Graph 4: Improvement seen in Left lower extremity

Table 4: Inter-group comparison of Average improvement in Left Lower Extremity

Mann Whitney Test	Left Leg
BLR Improvement	14.333
PNF Improvement	6.333
P value	< 0.0001

P value is < 0.0001, which is considered extremely significant. This shows that improvement gained using Mulligan BLR technique was significantly more than that gained using PNF technique.

Table 5: Intra-group comparison of average improvement in the BLR group

Paired t – test	Right leg	Left leg	P value
BLR Improvement	14.067	14.333	0.3008

P value is 0.3008, which is not considered significant. There was no significant difference between right and left lower extremities in the improvement gained by BLR technique

Table 6: Intra-group comparison of average improvement in the PNF group

Wilcoxon matched-pairs signed-ranks test	Right Leg	Left Leg	P value
PNF Improvement	6.4	6.333	0.8457

P value is 0.8457, which is not considered significant. There was no significant difference between right and left lower extremities in the improvement gained by BLR technique.

5. Discussion

The intervention protocol for both the groups was given for 6 consecutive days; pre and post AKE measurements were documented. The subjects in Mulligan BLR group have shown statistically significant improvement in their hamstrings flexibility with 6 days intervention (as seen on comparison of their pre and post AKE readings). In Mulligan BLR technique, once the muscle is taken to a stretched position, contract-relax maneuver is applied 3 – 4 times following which the muscle is taken into further stretch that is maintained for about 20 seconds. This technique works according to the principle of autogenic inhibition^[8]. This is caused by activation of Golgi Tendon Organ(GTO) – a musculotendinous proprioceptor. The GTO, located between the muscle belly and its tendon, senses increased tension when the contracts or stretches. When the target muscle(hamstrings) contracts, the GTO is activated and responds by inhibiting this contraction (reflex

inhibition) and contracting the opposing muscle group(antagonist). Thus, allowing the target muscle (hamstrings) to relax and stretch further easily. The PNF Agonist Contraction group have also shown statistically significant improvement in their hamstring flexibility with 6 days intervention (as seen on comparison of their pre and post AKE readings). This technique works according to the principle of reciprocal inhibition^[8]. Reciprocal inhibition refers to a phenomenon in which an afferent signal activates an excitatory neuron to a group of muscles and simultaneously activates inhibitory signal to other, usually antagonist group of muscles. In this case, resistance is applied to the contraction of quadriceps muscle (agonist) at the end of available range. This resistance stimulates the proprioceptors of the muscle which on one hand send excitatory afferents to the spinal arc that cause contraction of quadriceps, while simultaneously send afferents to excite the inhibitory interneuron that synapses with motor neuron supplying the antagonist i.e. hamstrings muscle. This causes hamstrings to relax and allows further stretch, thus increasing its flexibility. Thus, both these techniques are clinically useful in increasing hamstrings flexibility. There was no significant difference on comparison between improvement in right and left lower extremity within the same group (table 5 and 6). But, on comparison between the groups i.e. between these two techniques (graph 3,4 and table 3,4), it was seen that improvement gained from Mulligan BLR technique in 6 days is more than that gained from PNF Agonist Contraction technique in same number of sessions. Mulligan BLR has biomechanical effects on pelvis movements, on lumbosacral neural structures also apart from hamstrings muscle. The BLR technique works on the neural tissue component and also on the low back leading to increased flexibility as compared to PNF Agonist contraction. Pelvic positioning in Mulligan BLR has an effect on hamstrings length^[6]. These may be the probable reasons for better efficacy of BLR as compared to PNF Agonist contraction technique in improving extensibility of hamstrings muscle.

In a study carried out by Cheraladhan E. Sambandam^[4], Mulligan’s Bent leg raise(BLR) was found to be significantly more effective than passive stretching in healthy females with hamstrings tightness which is similar to the results of our study. In contrary, a similar study carried out by Oves Patni.et.al.^[9], it was concluded that hamstring flexibility gains obtained from a single bout of both passive stretching and BLR were almost similar and difference between the two interventions were negligible. Toby Hall et al^[10] (2005) concluded that after a single intervention of Mulligan’s BLR technique, immediate improvement were not observed but the technique was effective in improving the range of straight leg raise (SLR) after 24 hours. They also added that BLR technique was no better than placebo.

6. Conclusion

The present study concludes that Mulligan BLR and PNF Agonist Contraction interventions both significantly improve hamstrings flexibility. Mulligan BLR technique is better than PNF agonist contraction in improving hamstrings flexibility. Thus, clinically both Mulligan BLR technique

and PNF Agonist Contraction technique can be used as adjuncts to improve hamstrings flexibility.



Priti Nisheet Agni is MPTTh Neurosciences (MUHS), Assistant Professor in K.J.Somaiya college of Physiotherapy

7. Limitations

Study was conducted with a small sample size. Also, intra-observer error could not be eliminated. Study can be performed on different age group. Intervention period can be longer

8. Future Scope

Similar study can be done on neurological patients as stretching is an integral part of their protocol. Study could be done with more than one therapist so that intra-observer error can be eliminated. Also it is seen that studies about Mulligan BLR technique are variable [9] and studies about PNF Agonist Contraction technique alone is scarce. The results of this study can therefore be of use for further large scale research in this area.

References

- [1] Therapeutic Exercise: Foundations and Techniques; Carolyn Kisner, Lynn Allen Colby; 5th Edition, pg 174 – 192.
- [2] Comparison of different sit and reach tests for measurements of hamstring flexibility; Baltaci, Besler; School of Physiotherapy and Rehabilitation; Turkey 13th May,2004.
- [3] Manual Therapy: NAGs, SNAGs, MWMs; Brian Mulligan, 6th edition
- [4] Comparison of immediate effect of mulligan bent leg raise technique vs. Passive stretching on hamstring tightness in healthy female volunteers; Cheraladhan E. Sambandam , Sejal N. Sailor , Tiruttani Ramesh; International Journal of Current Research and Review; Vol. 03; issue 05; 31 – 35.
- [5] Karnati, V., & Ali Mohammed, A. (2015). Static versus pnf stretching in hamstring flexibility-a comparative study. International Journal of Physiotherapy, 2(3), 513- 517.
- [6] Hamstring muscle tightness: Reliability of an active knee extension test; C.M. Norris; Physical Therapy Journal; July; 63(7);1085-90.(2005)
- [7] Manual of Mulligan Concept, Dr. Deepak Kumar; Revised Edition.
- [8] Textbook of Medical Physiology; Indu Khurana.
- [9] Effect of single bout of passive stretching and Mulligan's Bent Leg Raise (BLR) on Hamstring flexibility in young adults with asymptomatic bilateral Hamstring tightness Oves Patni , Saravanan M , Aliya Shaikh , Ankita Juneja , Nazrana Shaikh , Ruchi Patel; IOSR Journal of Dental and Medical Sciences (IOSR-JDMS); Volume 9, Issue 3 (Jul.- Aug. 2013), 13-17.
- [10] T. Hall et al. / Manual Therapy 11 (2006) 130–135

Author Profile



Varsha Venkitaraman is B.P.Th - K . J . Somaiya College of Physiotherapy.

Volume 6 Issue 9, September 2017

www.ijsr.net

[Licensed Under Creative Commons Attribution CC BY](https://creativecommons.org/licenses/by/4.0/)