Carry over effect of bent leg raise stretch on hamstring muscle flexibility

Shweta Aswale¹, Anagha Kadam², Rani Shethiya³

¹Intern, Department of Physiotherapy Dr. D.Y. Patil College Of Physiotherapy, Pimpri, Pune 411018, Maharashtra, India
²Intern, Department of Physiotherapy Dr. D.Y. Patil College Of Physiotherapy, Pimpri, Pune 411018, Maharashtra, India
³Intern, Department of Physiotherapy Dr. D.Y. Patil College Of Physiotherapy, Pimpri, Pune 411018, Maharashtra, India

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Abstract

Flexibility is a vital component of fitness required for most desirable musculoskeletal functioning and maximizing the performance of physical activities. Flexibility dysfunction is a widespread problem faced by common as well as sports persons, especially in case of hamstring group of muscles. Hamstring tightness is not only a causative factor for reduced range of motion but it can also lead to various other musculoskeletal problems, Stretching is general term used to describe any therapeutic manoeuvre designed to increase the extensibility of soft tissues, thereby improving flexibility and ROM by elongating structures that have adaptively shortened and have become hypo mobile over time. Mulligan BLR technique consist of gentle isometric stretching of hamstring in specific directions in progressively greater positions of the hip flexion, the expecting result are increased flexibility of hamstring muscle with increased ROM of active knee extension. The study performed was an experimental study on 30 students with hamstring tightness, of age group 18-25 years, both genders of Dr. D.Y. Patil College of Physiotherapy. The pre and post assessment was done by active knee extension test and SLR by goniometer after assessment Mulligan BLR was given to the selected students. This study concluded that the Mulligan bent leg raise is effective in improving hamstring flexibility, increasing active SLR range and shows sustained effect after 1 week of treatment.

Keywords: Active knee extension test, Goniometer, Hamstring flexibility, Hamstring tightness, Mulligan bent leg raise, SLR.

Introduction:

In human anatomy, a hamstring is one of the three posterior thigh muscles in between the hip and the knee (from medial to lateral: Semimembranosus, semitendinosus and bicep femoris). The hamstrings are quiet susceptible to injury. This muscle originates from ischial tuberosity and insert in the tibia.

The hamstring crosses and acts upon two joints- the hip and the knee. Semitendinosus and semimembranosus extend the hip when the trunk is fixed. The bicep femoris extends the hip, as when beginning to walk. The hamstring plays a crucial role in many daily activities such as walking, running, jumping, and controlling some movement in the trunk.
Flexibility is a vital component of fitness required for most desirable musculoskeletal functioning and maximizing the performance of physical activities. Flexibility dysfunction is a widespread problem faced by common as well as sportspersons, especially in case of hamstring group of muscles. Hamstring tightness is not only a causative factor for reduced range of motion but it can also lead to various other musculoskeletal problems. Tight hamstring muscles limit anterior pelvic tilt of the pelvis in spinal flexion resulting in aggravated muscle and ligamentous tension in the lumbar region which leads to significantly higher compressive loads on the lumbar spine. Anatomical causes of reduced muscle extensibility have been categorized as “muscle shortness” and “muscle stiffness”. Physiological cause of reduced muscle extensibility is related to the contractility of the muscle cell.
Prevalence and incidence of hamstrings tightness in normal individuals in day today life is high due to limited activity and lack of regular exercise. Tight hamstrings usually start at the age of 5-6 years, when children start their seated careers.

It has been observed that 75% of boys and 35% of girls aged 10 revealed reduced flexibility of hamstring and confirmed that this observation has to be done in 15-17 year old boys. Akinpelu et al. performed study on influence of age on hamstring tightness in apparently healthy Nigerians. In which they concluded hamstring tightness increases in apparently healthy Nigerians from childhood up to age 40-49 years and it is higher in males then females.

Stretching is general term used to describe any therapeutic manoeuvre designed to increase the extensibility of soft tissues, thereby improving flexibility and ROM by elongating structures that have adaptively shortened and have become hypo mobile over time. The goal of all stretching programs is to optimize joint mobility while maintaining joint stability.

Mulligan BLR technique consist of gentle isometric stretching of hamstring in specific directions in progressively greater positions of the hip flexion, the expecting result are increased flexibility of hamstring muscle with increased ROM of active knee extension. Mulligan bent leg raise (BLR) technique has been described as a mean of improving range of straight leg raise (SLR) in subject with LBP and or referred thigh pain.

The Mulligan bent leg raise technique has been described as a means of improving range of straight leg raise (SLR) in subjects with LBP and or referred thigh pain. It stretches the lower extremity muscles in combination of hamstring, adductors, and rotators.

Improvement of SLR range because of BLR technique might be due to mobilization of painful sensitized nerve tissues, similar to the slider effects described by Butler.

Another beneficial effect of the BLR technique might be change in stretch tolerance of the hamstrings. Jonhagen et al. demonstrated that the increase range of SLR, following stretching is mediated by the increase in hip flexion and pelvic rotation as well as hamstring length and not related to increase to increased hamstring viscoelastic properties.

Need of study:

Hamstring tightness is not only a causative factor for reduced range of motion but it can also lead to various other musculoskeletal problems. Length-tension relationship of muscle as well as shock absorbing ability of the limb is affected by tightness of muscle. This leads to reduce hamstring muscle flexibility. In order to increase the hamstring flexibility bent leg raise technique has been used most commonly. The bent leg raise technique shows an immediate effect on the hamstrings. But there are limited study exploring the carry over effect of BLR technique. So, the purpose of the study is to find the carryover effect of bent leg raise technique on hamstring flexibility.
Aim and objectives:

AIM: To study the carry over effect of bent leg raise test stretch on hamstring flexibility.

Objectives:

1. To see the efficacy of BLR stretch technique on hamstring flexibility.
2. To see the effect of BLR stretch on SLR range.
3. To see whether the changes are sustained after one week treatment.

Materials and methodology:

An experimental study with convenient sampling was conducted on 30 students with hamstring tightness, of age group 18-25 years, both genders of Dr. D.Y. Patil College of Physiotherapy. A written consent was taken prior giving any treatment, patients with any history of recent injury/trauma or accident, any neurological disorder, pregnancy, PIVD were excluded from the study. A pre and post assessment was done by active knee extension test and SLR through goniometer before and after treatment. After assessing the participant’s treatment was given by mulligan bent raise stretching technique.

Procedure

The study subject was selected according to the inclusion exclusion criteria. The subjects were explained the objectives of the study and its procedure. A written consent was taken from all the participants.

A pre and post assessment was done by active knee extension test and SLR ranges through goniometer before and after the treatment on day 1, day 2, and day 3. A follow-up assessment was done on day 10.

Active knee extension test: - the subject was in supine position. The side to be measured was taken in hip and knee 90° of flexion. Fulcrum of goniometer was placed on condyle of femur, stationary arm was parallel to shaft of femur and movable arm was moved with reference to lateral melleoleus.

Subject with less than 125° of active knee extension was taken and the data was recorded.
After assessing the participant's treatment was given by mulligan bent raise stretching technique:

1. The patient was asked to lie supine on the edge of the plinth, with the hip and knee in flexion (90) and heel off the plinth. The patient was asked to hold the plinth from unaffected side, the other affected hand under his/her head and neck.
2. The therapist placed his/her shoulder of inner hand under the patient's popliteal fossa and grasps the lower end of the thigh with both hands.
3. The therapist then applied traction along the long axis of femur; the therapist took the hip into flexion until first resistance is felt. If the patient complains of stretch pain, the patient will be asked to push the therapists shoulder gently (hold for 5 sec), the therapist took the patients hip into further flexion, if pain free.
4. As the patient complains of THE pain during this maneuver, then hip was moved into abduction or external rotation. The therapist holds the end position for about 20 seconds.
5. 3 repetitions were given at a time for 3 days.
The treatment was continued for 3 days and after a week again the tightness of the muscle was checked and the data was recorded.

**Outcome measures:**

The outcome measures for this study are:

1. Active SLR range of motion in supine position.
2. Tightness of Hamstring muscle by active knee action test

Readings were taken:
- Prior to and after the first treatment.
- Prior to and after the second treatment.
- After the third treatment
- After one week of the last treatment.

The reading of before the first treatment and after the last treatment was compared. As well as after the first treatment and that of one week later was compared.

Reading was recorded and compared in the following table:

<table>
<thead>
<tr>
<th>Date</th>
<th>Tightness</th>
<th>ROM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>Day 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Data analysis and interpretation**

Table no 1: Mean difference of pre treatment day 1 and post treatment tightness values of each day as calculated using ANOVA

P-value= <0.001

<table>
<thead>
<tr>
<th>Mean difference(MD) of pre post</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD 1(MD b/w day 1 (pre) and day 1(post))</td>
<td>7.4˚</td>
<td>2.4˚</td>
</tr>
<tr>
<td>MD 2(MD b/w day 1(pre) and day 2(post))</td>
<td>15˚</td>
<td>3.2˚</td>
</tr>
<tr>
<td>MD 3 (MD b/w day 1 (pre) and day 3 (post))</td>
<td>22.3˚</td>
<td>4.7˚</td>
</tr>
<tr>
<td>MD 10 (MD b/w day 1(pre) and day 10)</td>
<td>18.6˚</td>
<td>4.7˚</td>
</tr>
</tbody>
</table>
Graph I: this graph shows comparison of mean difference of pre treatment day 1 and post treatment tightness of each day and day 10

Interpretation: the above graph shows that mean difference of pre treatment tightness of hamstring was 7.4; mean difference of post treatment day 3 tightness thus increasing thus increasing significantly, which decreased slightly on day 10, 22.3 as compared to day 3 but still remained higher as compared to day 1 significantly, which decreased slightly on day 10, 22.3 as compared to day 3 but still remained higher as compared to day 1.

Table no 2: Mean difference of pre-treatment day 1 and post treatment ROM values of each day as calculated using ANOVA

<table>
<thead>
<tr>
<th>Mean difference pre and post</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD 1 (MD b/w day 1 (pre) and day 1 (post))</td>
<td>17.8˚</td>
<td>4.3˚</td>
</tr>
<tr>
<td>MD 2 (MD b/w day 1 (pre) and day 2 (post))</td>
<td>31.9˚</td>
<td>8.5˚</td>
</tr>
<tr>
<td>MD 3 (MD b/w day 1 (pre) and day 3 (post))</td>
<td>46˚</td>
<td>11.2˚</td>
</tr>
<tr>
<td>MD 10 (MD b/w day 1 (pre) and day 10)</td>
<td>40˚</td>
<td>12.5˚</td>
</tr>
</tbody>
</table>
Graph II: this graph shows comparison of mean difference between day 1 pre intervention with post intervention ROM of each day and day 10.

Interpretation: the above graph shows that the mean difference of pre treatment SLR ROM was 17.8˚, immediate post treatment ROM was 46.7˚ and after day 10 was 40.2˚ which shows that there was statistically high significance post day 3 which decreased slightly after day 10 but still showed higher significance than day 1.

Result

1. Table 1 and graph 1 interprets the data baseline mean difference of tightness of Hamstring muscle, pre treatment day 1 with day 1 post treatment (7.4˚), day 2(15˚), day 3 (22.3˚) and on day 10(18.6˚). The data analysis was statistically of high significance calculated using ANOVA test. This shows that BLR is effective in improving hamstring flexibility.

2. Table 2 and graph 2 interprets the data baseline mean difference of SLR ROM, pre treatment day 1 with day 1 post treatment (17.8˚), day 2(31.9˚), day 3 (46.7˚) and day 10 (40.2˚). The data analysis was statistically of high significance calculated using ANOVA test. This shows that BLR is effective in improving the SLR range.

Discussion

The aim of the study was to study the carryover effect of mulligan bent leg raise technique on hamstring flexibility, in physiotherapy students aged 20 to 25 years having hamstring tightness. The flexibility of the subject was assessed by 2 methods i.e. ‘active knee extension test and active SLR’ by goniometry. The study was conducted among 30 asymptomatic students of Dr. D Y Patil Physiotherapy College. The hamstring tightness and active SLR ranges were noted pre and post the treatment for 3 days and a follow was taken on the day 10.
If the hamstring muscle is not stretched regularly then there is great chance of the muscle going into tightness. Tightening of the fascia is a biomechanics protective mechanism due to response to trauma, it loses its pliability and becomes restricted. Anatomical causes of reduced muscle extensibility have been categorized as "muscle shortness" and muscle stiffness. The Mulligan BLR stretch allows full lengthening of the muscle and to regain flexibility for functional use.

The outcome measure for this study was Active knee extension test measured by goniometer. Phansopkar and Kage in the year 2014 concluded that active knee extension test is reliable and valid tool in measuring the hamstring muscle tightness, with reliability coefficients for test measurement were 0.99 and reliability coefficient for re test measurement were 0.99.

The current study shows that there was highly significant increase in hamstring flexibility. The subject showed higher results in post immediate effect (day 1). When compared to Day 1 the carryover effect was significantly higher as compared to immediate post treatment (day 3). The tightness increased slightly during the week after day 3 where treatment was not given. Though tightness had increased slightly but it still remain less as compared to day 1 which shows that carryover effect of the BLR stretching on hamstring tightness is highly significant as also indicated by the p-value (p<0.001). This indicates that the BLR stretching causes immediate as well as sustained effect on hamstring tightness. The Mulligan BLR technique consist of gentle isometric stretching of hamstring in specific directions in progressively greater positions of hip flexion, this results in increased hamstring flexibility of hamstring muscle with increased active knee extension.

The study done by Ovaspatni, Aliya sheikh, et al in the year 2013 in which 78 asymptomatic individuals with bilateral hamstring tightness were randomly taken and effect of single bout of passive stretching and Mulligan bent leg raise was seen and it stated that BLR and passive stretching intervention did significantly improve hamstring flexibility.

A study done by Phadnis TR and Bhave SM, in the year 2018 in which 60 asymptomatic students with hamstring tightness were taken and effect of Mulligan bent leg raise vs. hold relax proprioceptive neuromuscular facilitation was done and it stated that there is significant improvement with Mulligan BLR as compared to hold relax PNF in improving functional ability and active knee extension range of motion in high school students with hamstring tightness.

The hamstring tightness cause decrease in the SLR range. Thus active SLR range was also included as an outcome measure in this study by goniometer. TiagoNeto, et al in the year 2014 studied the reliability of the straight leg raise test I subjects with flexibility deficits, they concluded that the slr have an excellent intrarater reliability of (0.93-0.97).

The current study shows that there was significant increase in the SLR ranges after BLR. The subject showed higher result in post immediate effect, the mean difference in pre and post treatment was 17.8 (day 1). There was increase in the mean difference on day 3 which was 46.7 comparatively higher than day 1 pre. There was slightly decrease in SLR range on day 10, the mean difference was 40.2, but still it is higher than day 1 pre intervention, which shows the carryover effect of Mulligan BLR on the SLR ranges, also indicated by the p-value (0.00) which is
highly significant. Improvement of SLR range, by BLR technique might be due to mobilization of painful, sensitized, nerve tissues, similar to the “slider” effect described by Butler. With the bent knee over the shoulder it adds traction component when subject places his leg on the therapist’s shoulder. BLR is effective as it changes the stretch tolerance of hamstring.

Hall et al. have done a study on Mulligan bent leg raise technique a preliminary randomized trial of immediate effects after a single intervention, this study provided preliminary evidence that a single intervention of Mulligan’s BLR technique, results in improvement in range of SLR 24 hours later but not immediately after the intervention, relevant to our study which shows a increase in hamstring flexibility within 24 hours.

BLR technique triggers neurophysiologic response influencing the muscle stretch tolerance. It releases the scar tissue adhesion to allow full lengthening of the muscle and to regain flexibility for the functional use. It is concluded that hamstring in hip flexion provides peripheral somatic input by the way of contacting muscle and the coetaneous contact of therapist.

The Golgi tendon organ around knee, hip and spine initiates various segmental reflex pathway during traction of the limb. Likewise, Golgi tendon organs are activated during large amplitude stretching movements as SLR. This processing of information in the nervous system may inhibit the activity of the muscle being lengthened during SLR by damping the afferent activity of type II muscle spindles. Hence, improvement in range of SLR may be directly related to inhibition of the hamstring muscles rather than to changes to stretch tolerance.

As the Mulligan BLR cause the neural mobilization of nerve (sciatic nerve) which results in increase in hamstring flexibility as well as increased SLR range.

Thus the result of the present study shows highly significant effect of carryover effect of Mulligan bent leg raise on hamstring flexibility and increase in the SLR ranges. CONCLUSION

This study concludes that the Mulligan bent leg raise is effective in

- Improving the hamstring flexibility
- Increasing the active SLR range
- The BLR stretching shows sustained effect after 1 week of treatment.

Limitation

- Focuses volunteer only in Dr. D. Y. Patil College of physiotherapy.
- Limited age criteria
- Small sample size

Future scope

- Vast sample size
- Study participants can be included from different field.
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