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COMPARISON OF MULLIGAN'S BENT LEG RAISE AND NORDIC ECCENTRIC HAMSTRING STRETCHING ON HAMSTRING FLEXIBILITY IN INDIVIDUALS BETWEEN18-35 YEARS AGE GROUP

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ABSTRACT:

Aim: To study the effect of Mulligan's bent leg raise and Nordic eccentric hamstring stretching on hamstring flexibility in individuals between 18-35 age group.

Background: The flexibility of hamstring muscle is crucial and of utmost importance for health care professionals because hamstring tightness is associated with several musculoskeletal overuse injuries Thus one needs to know the most effective and efficient technique to increase hamstring flexibility.

Procedure: This comparative study was conducted on 60 individuals of age group 18-35 years according to inclusion criteria. They were divided into two groups through convenient sampling. Group A received Mulligan's bent leg raise session on alternate days with 3 repetitions for 4 weeks and Group B received Nordic eccentric hamstring stretching session twice a week 3 sets of 6 repetitions for 4 weeks. Data was statistically analyzed using paired t test and unpaired t test.

Result: Both the techniques have on effect in improving hamstring flexibility in individuals between 18-35 years age group. Using unpaired t test mean difference value of popliteal angle in group A (MBLR) was 28.8 and in group B (NEHS) was 23.63 with p value <0.0001 considered extremely significant.

Conclusion: Mulligan's bent leg raise technique is more effective than Nordic eccentric hamstring stretching to increase hamstring flexibilityin individuals between 18-35 years age group.

Keywords: Hamstring flexibility, Mulligan Bent Leg Raise, Nordic Eccentric Hamstring Stretching

INTRODUCTION

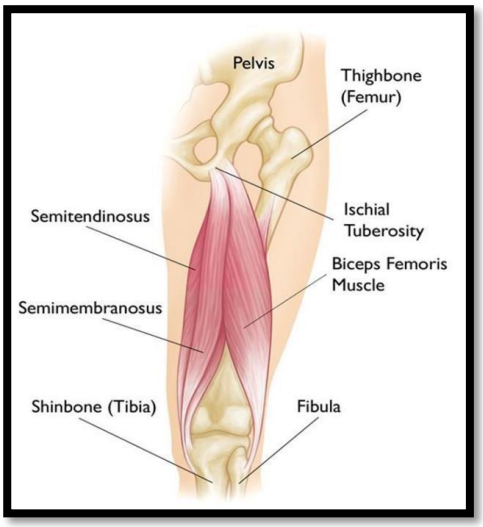
The Hamstring muscles lie on the posterior region of the thigh. The hamstring consists of four muscles: semimembranosus, semitendinosus, biceps femoris and ischial part of adductor magnus which originates from the ischial tuberosity. These four muscles combined are primarily responsible for flexion of knee joint as well as extension of hip. Muscle tightness is caused by decrease in ability of the muscle to deform which results in decreased range of motion in the joint on which it acts. Tightness will lead to reduced flexibility of muscle[1].

Hamstring is a biarthrodial muscle which contracts eccentrically to maintain proper erect posture in standing hence are more prone to be tight[2].

Hamstring play important role in routine activities such as walking, running, jumping and controlling some movements in trunk. In ambulation they are most important as an antagonist to the quadriceps muscle in the deceleration of knee extension[3].

The peculiar characteristics of the hamstring muscles- biarthrodial, made predominantly of type II fibers, and containing less titin protein- may put the muscle group at higher risk of strains[4].

Figure no.1: Hamstring muscle



The term muscle tightness refers to the adaptive shortening of the contractile and non-contractile elements of the muscle[5]. The word flexibility is derived from the Latin,"Flectere" or "Flexibilis" which means "to bend". Flexibility is ability to move a single joint or series of joint through an unrestricted pain free range of motion[6].

The prevalence of hamstring tightness in male is 27.50% and in female 45% in the age group of 18-25 years. The prevalence and incidence of hamstring tightness in normal individuals in day to day life is high owing to lack of regular exercise and limited activity[5].

Inability to achieve more than 160 degrees of knee extension with hip kept at 90 degrees of flexion contributes hamstring tightness. Tight hamstrings were shown to decrease the lumbar lordosis in sitting and thus increase in pressure in the lumbar intervertebral discs and the loading on the lumbar spine[1]. Tight hamstrings can cause your hips and pelvis to rotate back flatteningthe lower back leading to back problems[6].

When hamstring musculature undergoes tightness it changes the normal alignment of body posture. Till date studies have shown that tightness of hamstring always leads to low back pain with lumbar intervertebral disc pathologies. Biomechanically tightness of hamstring muscle is thought to increase patellofemoral joint compressive forces because of increase in passive tension at the time of swing phase of ambulation. Under rapid and stressful situations hamstring muscles fails to pass through full physiologicalamplitude when specifically this muscle goes for tightness[7]. During terminal swing before heel strike hamstring are susceptible to injury. During terminal swing of gait hamstring appear to be the most biomechanically exposed[8].

The flexibility of hamstring muscle is crucial for general and athletic population and is very essential for health care professionals, to attain this goal one needs to know the most effective and efficient technique to gain hamstring flexibility. There are various treatment for the hamstring stretching like active release technique, passive stretching, static stretching, PNF stretching techniques, eccentric stretching exercises for improving hamstring flexibility[9].

Mulligan's bent leg raise is a painless technique and can be applied on any patient who has limited or painful SLR. Bent leg raise technique consist of gentle isometrics stretching of hamstring in specific direction in greater positions of hip flexion, the expecting results are increase flexibility of hamstring muscle with increased range of motion of active knee extension. Beneficial effect of bent leg raise technique might be due to change in stretch tolerance of hamstring[5].

The aim of Nordic exercise is to strengthen the hamstring, gluteus and core muscles. Nordic eccentric exercises reduces hamstring strain risk. The Nordic eccentric hamstring stretching exercise improves total work of eccentric hamstring musculature and has received increase interest as it improves range of motion and flexibility[1].
Both the mechanism discussed above were effective in improving hamstring flexibility but evidence for comparison between these two groups are less so the aim of present study is to study the effect of Mulligan's bent leg raise and Nordic eccentric hamstring stretching on hamstring flexibility.

PURPOSE OF THE STUDY

Hamstring flexibility is important for normal day to day activities. Restricted hamstring flexibility has been shown to predispose a person toseveral musculoskeletal overuse injuries like patellofemoral syndrome and significantly affect the person's level of function.

Therefore the purpose of this study is to compare the effect of mulligan's bent leg raise and Nordic eccentric hamstring stretching on hamstring flexibility in individuals between 18-35 years age group.

AIM OF STUDY

To study the effect of Mulligan's bent leg raise and Nordic eccentric hamstring stretching on hamstring flexibility in individuals between 18-35 years age group.

OBJECTIVES OF STUDY

- To find out effect of mulligan's bent leg raise on hamstring flexibility in individuals between 18-35 years of age group.
- To find out effect of Nordic eccentric hamstring stretching on hamstring flexibility in individuals between 18-35 years ofage group.
- To compare the effect of mulligan's bent leg raise and Nordic eccentric hamstring stretching on hamstring flexibility inindividuals between 18-35 years of age group.

HYPOTHESIS

Mulligan's bent leg raise is more effective than Nordic eccentric hamstring stretching on hamstring flexibility in individuals between 18-35 years of age group.

ALTERNATE HYPOTHESIS

Nordic eccentric hamstring stretching is more effective than Mulligan's bent leg raise on hamstring flexibility in individuals between 18-35 years of age group.

NULL HYPOTHESIS

Mulligan's bent leg raise and Nordic eccentric hamstring stretching are equally effective on hamstring flexibility in individuals between 18-35 years of age group.

METHODOLOGY:

Type of study: Comparative study

Type of sampling: Convenient sampling

Sample size: 60

No. of groups: 2

Group A: Mulligan's bent leg raise: 30 subjects

Group B: Nordic eccentric hamstring stretching: 30 subjects

Study setting: Dr. Vasantrao Pawar Medical College, Hospital and Research Centre, Nashik.

Study duration: 6 months

SELECTION CRITERIA:

INCLUSION CRITERIA

1. Male and female[1].
2. Subjects with hamstring tightness[2].
3. Age: 18-35 years[10].
4. Inability to achieve greater than 160 degree of knee extension with hip at 90 degree of flexion[11].

EXCLUSION CRITERIA

1. History of lower limb injury within the previous 12 months[10].
2. Any recent surgery of lower limb[11].
3. Any pathological dysfunction[1].
4. Recent history of orthopaedic disorder affecting lower limb(eg. femoral fracture, meniscal injury and ligaments injury)[11].
5. Neurological dysfunctions[12].

MATERIALS USED

- Pen
- Paper
- Universal goniometer
- Mat
- High couch
- Mulligan belt
- Consent form

Figure no. 2: Materials used

OUTCOME MEASURE:

Popliteal angle measurement

The subjects were taken according to the inclusion and exclusion criteria. The procedure was explained to the subjects and written consent was taken. Total 60 subjects were allocated randomly in two groups: Group A (30) of Mulligan's bent leg raise and Group B (30) of Nordic eccentric hamstring stretching.
Baseline measurement of popliteal angle was assessed before and after intervention that was after 4 weeks.

POPLITEAL ANGLE RANGE MEASUREMENT:
The patient was in supine lying position on the plinth with neck in neutral and arms resting on the side and hip knee 90-90 degree. The therapist stands on the side to be tested and placed the stationary arm of the goniometer parallel to the femur and the movement arm parallel to the fibula. The therapist passively performed passive knee extension and measures the range pre- treatment and post treatment[13].

Figure no. 3: Popliteal angle range measurement

PROCEDURE

GROUP A: MULLIGAN'S BENT LEG RAISE:

Participant was in supine lying on a high couch with the investigator in walk stand position lateral to the leg which was being stretched. Hip and knee of the side to be stretch was bent at 90-90 degree. Investigator placed participant flexed knee over his shoulder, the popliteal fossa of the knee resting on his shoulder. A distraction (longitudinal traction force along the long axis of femur) was applied at the lower end of femur and the participant was ask to push the investigator's shoulder with his or her limb followed by voluntary relaxation. At this point of relaxation, the investigator pushed the bent knee up as far as possible in the direction of shoulder on same side in pain free range. This stretch was sustained for 5 to 10 seconds.

If the pain or restriction eases, the hip was taken further into flexion. It had to be ensured that there was no pain during the procedure; if it was painful the direction of leg raise was altered medially or laterally. The procedure was repeated till the knee of the participant was beyond the shoulder of therapist. The contralateral leg was kept relaxed and allowed to move as it goes. At theend of the range hold the position for 10 sec and brought back the limb to the neutral position. The traction was maintained throughout the technique[6].
This technique was given on alternate days with 3 repetitions for 4 weeks[5].

Figure no. 4: Mulligan bent leg raise

GROUP B: NORDIC ECCENTRIC HAMSTRING STRETCHING
Subject position: Hip and knee in 90-90 position with an erect torso.
The researcher secured the subject's ankle throughout the procedure. The participant then fell forward from the knee, resisting the fall for as long as possible with hamstring. As the participant's upper body approached the couch, the hands were quickly turn out to buffer the fall, letting the chest touch the couch. The participant had to keep the hip slightly flexed position throughout the Movement. On completion of Movement, the participant had to immediately return to starting position by thrusting themselves back up using their hands to minimize loading in the concentric phase. The exercise had to perform on relatively soft surface[1].
The Nordic eccentric hamstring stretching exercise was given twice a week, 3 sets of 6 repetitions for 4 weeks[9].

Figure no.5: Nordic eccentric hamstring stretching

DATA ANALYSIS:

Paired t test was done within the groups and unpaired t test was done between the groups.

Table No. 1: comparison of pre and post mean values of popliteal angle in Group A using paired t test

Parameter	Pre-treatment	Post-treatment
Group A: MBLR (Mean±SD)	34.2± 8.78	63±6.56
P Value	<0.0001	
T Value	28.29	
Significance	Extremely significant	

Table No. 2: Comparison of pre and post mean values of popliteal angle in Group B using paired t test.

Parameter	Pre-treatment	Post-treatment
Group B: NEHS (Mean±SD)	33.8±6.84	57.46±6.58
P Value	<0.0001	
T Value	25.32	
Significance	Extremely significant	

Table No. 3: Comparison of mean difference values of popliteal angle between group A and Group B

Parameter	Group A (MBLR)	Group B (NEHS)
Mean difference±SD	28.8±4.74	23.63±5.02
P Value	<0.0001	
T Value	4.097	
Significance	Extremely significant	

RESULT

The results of this study showed that Mulligan's bent leg raise and Nordic eccentric hamstring stretching is effective in improving hamstring flexibility in individuals between 18-35 years of age group, but when both techniques were compared it found that Mulligan's bent leg raise is more effective in improving hamstring flexibility.
Using unpaired t test mean difference value of group A (MBLR) is 28.8 and group B (NEHS) is 23.63 with p value is <0.0001 considered extremely significant.

DISCUSSION

The primary purpose of the study was to compare the effect of Mulligan's bent leg raise and Nordic eccentric hamstring stretching on hamstring flexibility in individuals between the age group 18-35 years.

60 subjects were taken based on inclusion criteria, age between 18-35 years both male and female gender, subjects having hamstring tightness with inability to achieve greater than 160 degree of knee extension with hip at 90 degree of flexion. Subjects having history of recent orthopedic disorder, any pathological dysfunction any neurological dysfunction were excluded. Measurements using popliteal angle was taken before and after treatment session. In the current study the group A intervention mean difference reading was 28.8 and mean difference reading of Group B was 23.63 with p value <0.0001 considered extremely significant.

The result of the present study demonstrated that both mulligan bent leg raise and Nordic eccentric hamstring stretching increases post intervention hamstring flexibility. After statistical analysis intergroup comparison showed that mulligan bent leg raise was more effective than Nordic eccentric hamstring stretching.

Mulligan bent leg raise technique releases the scar tissue adhesion to allow full lengthening of the muscle and to regain flexibility for functional use[12]. Improvement of range because of bent leg raise technique might be due to mobilization of painful sensitized nerve tissue. Another beneficial effect of bent leg raise technique might be a change in stress tolerance of the hamstring[6].

According to Buttler and Shacklock, Mulligan's bent leg raise technique utilizes passive flexion at the hip which is also caudal loading of the lumbosacral nerve root and sciatic nerve in the pelvis followed by active hip extension. With hip flexion during bent leg raise there is obligatory lumbar flexion. As lumbar flexion occurs, the lateral intervertebral foramina and central canal open further facilitating caudal movement of the neural structures. Improved mechanics of the neural structure would be one mechanism for improvement noted post Mulligan bent leg raise[10].

Various research over Mulligan's bent leg raise method suggest it as contract relax method ie contract relax cycle applied to hamstring provide peripheral somatic input to the contracting muscle. Mulligan's bent leg raise technique releases the scar tissue adhesion to allow full lengthening of the muscle and to regain flexibility for functional use[14].

According to Kage et al, Mulligan's bent leg raise technique would stretch entire posterior muscular sling from hamstring till thoracolumbar fascia. This has positive effect on reduction in lumbar lordosis index, thus having changes in lumbopelvic rhythm. Also mulligan bent leg raise technique is postulated to reach till the lumbar spine stretching the thoracolumbar fascia thus reducing the degree of lumbar lordosis. In addition to that the group also had the effect of convention physical therapy (passive static stretching) which also demonstrated to induce change sagittal curvature of spine[15].

Increase in hamstring flexibility by mulligan bent leg raise is because sciatic nerve passes through gluteus maximus and adductor magnus at hip level and this technique might release the adhesion between them. Stretching of gluteus maximus and adductor magnus as knee is kept in flexed position helps in breaking the adhesions between this muscles and sciatic nerve, hence mobilization of sciatic nerve will occur in relation to this muscles without the nerve getting stretched. It also helps in opening of facet joint and the intervertebral foramen of the lumbar spine as during end range pelvis goes into posterior tilt[16].

In Nordic eccentric hamstring stretching exercise during eccentric contraction the velocity of muscles lengthening increases initially along with the force production in the muscle the increase in the force production may be a protective response to the overload. The Nordic eccentric hamstring stretching exercise improves total work of eccentric hamstring musculature and has received increase interest as it improves range of motion and flexibility[1].

Eccentric exercise produces more muscle tension compared to concentric exercise. It produces a lengthening contraction. Total number of sarcomeres, which are arranged in series and parallel, increases with eccentric training. This form of exercise induces more rapid adaptations, by addition of sarcomeres.

Morgan D et al proposed that during active lengthening, myofilaments are stretched and some sarcomeres will be overstretched. They will become progressively weaker until the myofilaments no longer overlap. But when these eccentric contractions are repeated, over time more sarcomeres will be converted from weaker to stronger and they will not re integrate at the end of each contraction.
Based on the existing literature, eccentric contractions result in change in length of the sarcomere and a shift in the optimum angle. It is proposed that there will be an acute shift in length immediately after the eccentric exercise and a second shift in length after repeated training sessions.

Another study suggest that eccentric contraction can cause increase in passive tension of the muscle which might be the reason for improvement in flexibility after the Nordic eccentric hamstring stretching[8].

CONCLUSION

Mulligan's bent leg raise technique is more effective than Nordic eccentric hamstring stretching to increase hamstring flexibility in individuals between 18-35 years age group.

LIMITATIONS

- The result cannot be generalized to all age group.
- Other musculoskeletal problems such as low back pain were not taken into consideration.
- Long term follow up of the patients were not taken.

Conflict of interest: None
Ethical clearance: Yes
Disclaimers: None **Source of funding**: Self

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