Original Research Paper

Volume - 10 | Issue - 8 | August - 2020 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Physiotherapy

THE EFFECT OF ECCENTRIC TRAINING AND STATIC STRETCH FOR IMPROVING HAMSTRING FLEXIBILITY

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ABSTRACT Flexibility is the ability of a muscle to lengthen and allow one joint to move through a range of motion. Adequate flexibility is important to maintain balance, agility and musculoskeletal function. Without proper hamstring flexibility individuals will not be able to perform simple daily activities. Eccentric training is a contraction force that results in the lengthening of the muscle. Stretching is a flexibility exercise which helps to elongate soft tissue and its surrounding structures act in a form of elasticity and reaffirms comfortable muscle tone. This study is to find difference in effects between static stretching and eccentric training in hamstring flexibility. 20 subjects with limited hamstring flexibility were selected for this study. Study population consisted of two groups; group I received eccentric training (N=10) , group II received static stretching (N=10). The range of motion of knee was measured by Active Knee Extension test pre and post session. There was increase in range of motion of knee extension with eccentric training and static stretching of hamstring. However the increase was not statistically significant between the two groups.This study concludes that eccentric training and static stretching are equally effective in improving the hamstring flexibility.

KEYWORDS : Hamstring flexibility, eccentric training, static stretching

INTRODUCTION

The ability of an individual to move a joint depends on one's flexibility, an attribute that enhances both safety and optimal physical activity[1]. Flexibility is the ability of a muscle to lengthen and allow one joint to move through a range of motion (ROM). Adequate flexibility is important to maintain balance, agility and musculoskeletal function[2]. Hamstring muscles are well known for their great tendency to shortening, which is due to their multijoint condition, their tonic postural character , and considerable amount of tensional forces to which they are constantly submitted[3].

A hamstring is one of the three posterior thigh muscles in between hip and knee.

The common criteria of any hamstring muscles are:

1. Muscles will be originating from ischial tuberosity.
2. Muscles will be inserted over the knee joint, in the tibia or in the fibula.
3. Muscles will be innervated by the tibial branch of the sciatic nerve.
4. Muscles will participate in flexion of the knee joint and extension of the hip joint.[4]

The importance of hamstring muscle is that it can affect stride length, walking speed, and dynamics balance, Low back pain, body posture problems, poor locomotion, and susceptibility to musculoskeletal injuries are related to lack of hamstring flexibility.

Flexibility training is a vital component in reducing injury and also releasing pain. American College of Sports Medicine (ACSM) and American Heart Association (AHA) also suggest that flexibility training is essential to maintain the ROM which is required for daily physical activity. Most injuries occur in the eccentric phase of activity, where hamstring muscles mostly injured while working eccentrically during landing or decelerating. Hence, eccentric training could reduce injury rates, increase strength, prevent muscle damage, and improve flexibility. By definition, eccentric training is a contraction force that results in the lengthening of the muscle.[1]

Eccentric contraction/training that allows the muscle to elongate naturally and in its relaxed state this elongation is achieved by having the subject eccentrically contract the antagonist muscle to move the joint through full available range in slow controlled manner to stretch the agonist muscle group. It is a better training strategy to improve the flexibility and also able to increase the strength and protect against muscle damage.[5]

Stretching is a general term used to describe any therapeutic maneuver designed to increase soft tissue extensibility with the intent of improving flexibility and ROM by elongating (lengthening) structures that have adaptively shortened and have become hypomobile.[6] Stretching is also referred as a physical form of exercise in which a specific skeletal muscle is deliberately elongated to its fullest length in order to improve the muscles felt elasticity and reaffirm comfortable muscle tone.[7]

Three types of stretching have been traditionally defined in the literature in an effort to increase flexibility: ballistic stretching, proprioceptive neuromuscular facilitation, and static stretching. Ballistic stretching is a technique involving a rhythmic, bouncing motion. The bouncing uses the momentum of the extremity to lengthen the muscle. Proprioceptive neuromuscular facilitation involves the use of brief isometric contractions of the muscle to be stretched before statically stretching the muscle. Static stretching, considered the gold standard for measuring flexibility, is elongating a muscle to tolerance and sustaining the position for a length of time.[8] Static stretching is well accepted as an effective form of stretching it is thought that the Golgi tendon organ, which monitors tension created by stretch of a muscle tendon unit, may contribute to muscle elongation by overriding any facilitator impulses from the primary afferent of muscle spindle and may contribute to muscle relaxation by inhibiting tension in contractile unit of muscle being stretched.[5]

NEED OF STUDY

The need of this study is find out whether eccentric training and static stretch can improve hamstring flexibility.

REVIEW OF LITERATURE

1. **Abu Shaphe et al (2011)** conducted a study and concluded that static stretching is more effective than eccentric training in improvement of hamstring flexibility.
2. **Mohd. Waseem et al (2009)** conducted a study and concluded that Static stretching resulted in maximum improvement as compared to eccentric training/contraction on hamstring flexibility.
3. **William D. Bandy et al (2014)** conducted a study and concluded that static stretch is effective than Dynamic Range of Motion training.
4. **S Sudhakar et al (2016)** conducted a study and showed that Eccentric Training showed greater improvement than Static Stretching.
5. **Kieran O'Sullivan et al (2012)** conducted a systematic review and concluded that eccentric training can improve lower limb flexibility.
6. **Daniela Nice Ferreira et al (2007)** conducted a study and concluded that eccentric training is a better in increasing flexibility.
7. **Gopinathan Nair et al (2010)** conducted a study and concluded that eccentric training alone and eccentric training with static stretching is equally effective on improving hamstring flexibility.
8. **Diulian M. Medeiros et al (2016))** conducted a systematic review and showed that static stretching can improve flexibility.
9. **Russell T. Nelson et al (2004)** conducted a study and concluded

that both eccentric stretching and static stretching can improve hamstring flexibility.

10. **Jibi Paul et al (2015)** conducted a study and concluded that static stretching exercise found more effective over dynamic stretching exercise.

METHODOLOGY

Study design: Case series

Materials Used:

- Goniometer to measure ROM
- Theraband
- Stopwatch

Source of data:

Laxmi Memorial College of Physiotherapy, Balmatta, Manglore

SUBJECTS:

20 subjects with limited hamstring flexibility were selected and randomly divided into 2 groups.

- Group 1 received eccentric training(N=10)
- Group 2 received static stretching(N=10)

Sample Size:

20 college students.

Procedure:

The entire subject's initial knee extension ROM was measured by Active Knee Extension Test with the subject in supine position and hip and knee flexed to 90° by the researcher. The control group performed no stretching or eccentric activities.

Eccentric Training

The eccentric group performed full range-of-motion eccentric training for the hamstring muscles. The subject lay supine with the left leg fully extended. A 3-ft (0.91-m) piece of Theraband was wrapped around the heel and the subject held the ends of the Theraband in each hand. The subject was instructed to keep the right knee locked in full extension and the hip in neutral internal and external rotation throughout the entire activity. The subject was then instructed to bring the right hip into full hip flexion by pulling on the Theraband attached to the foot with both arms, making sure the knee remained locked in full extension at all times. Full hip flexion was defined as the position of hip flexion at which a gentle stretch was felt by the subject. As the subject pulled the hip into full flexion with the arms, he was instructed to simultaneously resist the hip flexion by eccentrically contracting the hamstring muscles during the entire range of hip flexion. Once achieved, this flexed hip position was held for 5 seconds, and then the extremity was gently lowered to the ground (hip extension) by the subject's arms. This procedure was repeated 6 times, with no rest between repetitions, thereby providing a total of 30 seconds of stretching at the end range.

Static Stretch

The static group statically stretched for 30 seconds.11 subjects performed the hamstring stretch by standing erect with the left foot planted on the floor and the toes pointing forward. The heel of the foot to be stretched was placed on a chair with the toes directed toward the ceiling. The subject then flexed forward at the hip, maintaining the spine in a neutral position while reaching the arms forward. The knee remained fully extended. The subject continued to flex at the hip until a gentle stretch was felt in the posterior thigh. Once this position was achieved, the subject maintained this position for 30 seconds. The new ROM or Active Knee Extension test is measured after the exercise.

INCLUSION CRITERIA:

- Students with hamstring tightness which is checked with 90-90 test.

EXCLUSION CRITERIA:

- The extremity to be tested had no history of impairment to the knee, thigh, hip, or lower back for 1 year before the study.
- Each subject exhibited tight hamstrings.
- Subjects not already involved in an exercise program for the trunk or lower extremities.
- Subjects who already were participating in a regular exercise program agreed not to increase the frequency or intensity of their program.

RESULT

20 individuals with hamstring tightness were divided equally into two equal groups and they were given two treatment protocols i.e., eccentric training and static stretching program. All the participants' knee extension ROM with hip and knee flexed to 90° was measured for both the legs before and after the treatment. Mean and standard deviation of the flexibility scores of all the participants is given below,

S.NO	GROUPS	MEAN	SD
1.	**Static stretching**		
	Initial ROM(Rt)	28.2667	5.53517
	Final ROM(Lt)	40.8667	6.66405
	Initial ROM(Rt)	31.6000	7.99821
	Final ROM(Lt)	44.0	6.05923
2.	**Eccentric Training**		
	Initial ROM(Rt)	29.0667	6.37480
	Final ROM(Lt)	42.667	7.67804
	Initial ROM(Rt)	28.4000	6.93645
	Final ROM(Lt)	49.0667	7.89635

Paired-t test was performed by SPSS (Statistical Package for Social Sciences) to find which treatment is more effective in hamstring tightened subjects. The means of pre-outcome and post-outcome values were compared to find their t-values and the protocol with highest t-value is considered the most effective and significant.

S.NO	GROUPS	SIDE	t-VALUE
1.	**Static Stretching**		
	Initial ROM-final ROM	Right	-6.963
	Initial ROM-final ROM	Left	-5.958
2.	**Eccentric Training**		
	Initial ROM-final ROM	Right	-7.697
	Initial ROM-final ROM	Left	-6.436

DISCUSSION

The purpose of the study was to determine the effect of eccentric training and static stretching on hamstring flexibility in individuals by calculating the ROM. These stretches are used as a measure of hamstring flexibility in common population. Although the modified hold-relax stretch and static stretches are the most commonly used field measures of hamstring flexibility.

The final result of the study indicated that the Eccentric training and static stretching were highly related to hamstring flexibility. The finding shows that both, Eccentric training and static stretch are valid for measuring in maintaining and improving flexibility because there was a great improvement in the knee extension ROM in all the participants.

The results of present study concluded that comparison of Eccentric training and static stretching groups showed that there was no significant difference in baseline readings. However, post analysis revealed a non-significant difference between group A and group B.

Modified hold relax stretching improves flexibility through relaxation of the contractile component of the muscles, while static stretching causes an increase in elasticity of the non-contractile viscoelastic component. Thus study demonstrated that both of these mechanisms play equal roles in improving the flexibility of the muscles. This study was demonstrated that hamstring flexibility remains significantly increased after the Eccentric training and static stretching protocol for 7 minutes.

A possible mechanism for the improvement of hamstring range of motion relies on the effects of autogenic inhibition is contingent on the function of the Golgi tendon organs, which not only detect changes in length but also changes in tension. Tension is produced in the antagonists with static stretching techniques. Therefore, the presence of autogenic inhibition would not be affected if the measurement technique was an active or passive stretch or if the training method was a static or hold relax stretch.

Although eccentric training of the hamstring muscles achieves the same flexibility gain as static stretching, the eccentric training offers a more functional option for flexibility training. Individuals training a muscle eccentrically may reduce the chance of injury by training the muscle in more functional type of activity. Further research comparing active knee extension and passive knee extension measurements may be useful in determining the best method for testing the effectiveness

of eccentric training and static stretching in improving flexibility.

REFERENCE

1. Nair A.Efficiancy of eccentric training alone and eccentric training and static stretching in hamstring flexibility in young students(PG thesis).Nitte institute of physiotherapy; 2010
2. Ruslan N, Norman W, Muhamad A, Madzlan N(2014). Effects of Eccentric Training Using Theraband on Hamstring Flexibility in Elderly. Proceedings of the International Colloquium on Sports Science, Exercise, Engineering and Technology, 127-134. DOI: 10.1007/978-981-287-107-7_13
3. Medeiros, D., Cini, A., Sbruzzi, G., & Lima, C. (2016). Influence of static stretching on hamstring flexibility in healthy young adults: Systematic review and meta-analysis. Physiotherapy Theory And Practice, 32(6), 438-445. doi: 10.1080/ 095 939 85. 2016.1204401
4. Chaurasia B D.(2018).Human Anatomy.7th edition.Volume 2.India:Jaypee Brothers Medical Publishers(P) Ltd.
5. Patel, P., & Yadav, A. (2013). Comparison of Static Stretching Versus Eccentric Training to Increase Flexibility of Hamstring Muscle in Healthy Hospital Nurses. Indian Journal Of Physiotherapy And Occupational Therapy - An International Journal, 7(2), 11. doi: 10.5958/j.0973-5674.7.2.003
6. Kisner C,Colby LA,Borstad J.(2018).Therapeutic Exercise Foundations and Techniques.7th edition.India:Jaypee Brothers Medical Publishers(P) Ltd.
7. Kuprian W, Eitner D(1994).Physical Therapy for Sports. 2nd ed. Philadephia: saunderi.
8. Nelson R, Bandy W(2004). Eccentric Training and Static Stretching Improve Hamstring Flexibility of High School Males. Journal of Athletic Training ,39(3),254–258.
9. Shaphe A,Waseem M,Begum S, Nuhmani S(2009). Improvement of Hamstring Flexibility: A Comparative Effectiveness between Static Stretching and Eccentric Training on Normal Healthy Collegiate Males, Journal of Indian Association of Physiotherapists,21-25.
10. Waseem M,Nuhmani S,Ram C,Ahmad F.(2009).A Comparative Study: Static Stretching Versus Eccentric Training on Popliteal Angle in Normal Healthy Indian Collegiate Males. International Journal of Sports Science and Engineering.3(3),180-186.
11. Bandy, W., Irion, J., & Briggler, M. (1998). The Effect of Static Stretch and Dynamic Range of Motion Training on the Flexibility of the Hamstring Muscles. Journal of Orthopaedic & Sports Physical Therapy, 27(4), 295-300. doi: 10.2519/ jospt. 1998.27.4.295.
12. Sudhakar S,Kumar M, Kirthika V,Rajalaxmi V.(2016). To Compare the Effects of Static Stretching and Eccentric Training on Hamstring Flexibility in Collegiate Male Athletes,International Journal of Physiotherapy& Occupational Therapy,2(2),39-44.
13. O'Sullivan, K., McAuliffe, S., & DeBurca, N. (2014). THE EFFECTS OF ECCENTRIC TRAINING ON LOWER LIMB FLEXIBILITY: A SYSTEMATIC REVIEW. British Journal Of Sports Medicine, 48(7), 648.2-648. doi: 10.1136/bjsports-2014-093494.234
14. Ferreira D, Labanca J, Silva M, Silva A, Anjos M, Pessoa C, Moraes G, Bittencour N(2007). Analysis of the Influence of Static Stretching and Eccentric Training on Flexibility of Hamstring Muscles. ISBS Symposium,454-457
15. Paul, J., & Balakrishnan, P. (2015). Comparative effect of static and dynamic stretching exercise to improve flexibility of hamstring muscles among male adults. International Journal Medical And Exercise Science, 01(02), 53-58. doi: 10.36678/ ijmaes. 2015.v01i02.002.