ORIGINAL RESEARCH

IJPHY

STATIC VERSUS PNF STRETCHING IN HAMSTRING FLEXIBILITY-A COMPARATIVE STUDY

[1]Venkata Naga Prahalada Karnati

[2]Ammar Mohammed Ali Mohammed

ABSTRACT

Background: Stretching used as a technique for injury prevention in the clinical settings, the study aimed to determine the early findings of hamstring tightness with both groups in the population, now a days the sedentary activities like prolonged sitting might cause hamstring tightness and change in path kinematics of gait intern lead to postural defects and back pain, understanding of the stretching helps clinician to make decisions for rehabilitation.

Methods: Across-sectional study, counterbalanced with repeated-measures , one group with static stretch – (double hamstring stretch and hurdlers stretch) for 3 times,30seconds subsequently in another group PNF contract relax(agonist contraction) technique for 10 seconds position and 10 seconds stretch repeated for 3 times.

Results: The results from data and statistical analysis by using t-test, SPSS obtained by using goniometer are tabulated in terms of mean, standard deviation and p-value in both groups. In experimental group flexion with PNF showed improvement 9.27±1.91(right side), 9.53±2.42(left side) and static stretching showed 7.8±2.91(right side), 7.47±1.96(left side) this proves that PNF has consistent improvement than static stretching

Conclusions: Static and proprioceptive neuromuscular facilitation stretching both have produced greater improvement but compared with PNF contract relax(agonist) stretching showed significant change in hamstring flexibility compared with control group . The effect sizes, however corresponding to these stretching-induced changes were small, which suggests the need for practitioners to consider a risk-to-benefit ratio when incorporating static or proprioceptive neuromuscular facilitation stretching.

Keywords: Static stretching, PNF Contract relax-agonist stretching, 90-90 SLR test, Tripod sign, Sit-reach box, Universal goniometer

Received 14th May 2015, revised 22nd May 2015, accepted 28th May 2015

DOI: 10.15621/ijphy/2015/v2i3/67023

www.ijphy.org

CORRESPONDING AUTHOR

[1]Venkata Naga Prahalada Karnati

Lecturer in Physiotherapy,
Department of Rehabilitation and Physical Therapy,
College of Applied Medical Sciences,
Shaqra University, Shaqra,
Kingdom of Saudi Arabia.

[2]Anatomist,
Department of Rehabilitation and Physical Therapy,
College of Applied Medical Sciences,
Shaqra University, Shaqra,
Kingdom Of Saudi Arabia.

INTRODUCTION

The term Hamstring was given to this muscle because hogs were hung up by them when slaughtered.[1] The ability to move a joint smoothly throughout a full range of movement is an important component of good health. The muscle flexibility defined as "the ability of a muscle to lengthen allowing one joint (or more than one joint in a series) to move through a range of motion." [2]

In a lordosis, the pelvis anteriorly tilted, and hangs on the hamstrings. In that posture, the hamstrings are likely to be, tight (increased tone) where as in other postures there length is likely to be unrelated to pelvic tilt.[3] A study on hamstring index by kuo L, Chung W, done to assess the limit of hamstring tightness in 369 children by using three common tests. viz SLR test, popliteal test, touching toes test, showed that an SLR of less than 80 degrees, popliteal angle less than 125 degree, touching toes test less than 15 cm is considered as hamstring tightness.[4]

Goniometric measurements taken on subjects with impaired knee range of motion found to be very reliable when using either the parallelogram or the universal goniometer. The study also revealed that it is preferable to use goniometry rather than visual estimations when measuring knee active range of motion particularly for the measurement of extension.[5]

The study sought to analyze the role of hamstring muscle in non-specific low back pain patients with a limited SLR concluded that the inability to touch the ground and a limited SLR mainly caused by a limited extensibility of the hamstrings. This limited extensibility not caused by increased muscle stiffness, but determined by the stretch tolerance of the patients.[6]

A study to evaluate the influence of pelvic restraint on EMG activation (neural drive) of the lumbar extensor, gluteal and hamstring muscles during of short hamstring muscles is negligible with an instrumental straight leg sub maximal dynamic lumbar extension in an upright-seated position has shown that the pelvic restraint is not required for the sub maximal lumbar extension exercises.[7]

In a study to examine the response of short hamstring muscle to repeated passive stretching has shown, the acute effects of repeated passive stretching of short hamstring muscles is negligible with an instrumental straight leg raising test.

A study has demonstrated a reliable method for studying resistance to stretch of human hamstring muscle group. Viscoelastic response of hamstring shown with five repeated stretches. Resistance to stretch diminished and each stretch exhibited a visco-elastic response. The effect of five repeated stretches was significant one-hour later.[8] In an another study, to examine stiffness, energy and passive torque in the dynamic and static phases of stretch maneuver in human hamstring muscle during passive knee extension using an isokinetic dynamometer proved that the method employed is an useful tool for measuring biomechanical variables during a stretch maneuver. This may provide a more detailed method to examine a skeletal muscle flexibility.[9]

According to Knott and Voss, PNF techniques are the methods of promoting or hastening the response of a neuromuscular mechanism through stimulation of proprioceptors. Based on these concepts of influencing muscle response, the techniques of PNF used to strengthen and increase flexibility of muscles.[2]

The best form of stretching is to use the benefit of reciprocal inhibition (relaxation) where the agonist produces the Stretching force on its antagonist with or without assistance of passive force. The contract relax method with agonist contraction produced a larger gains in hip flexion than either the contract relax or static stretching methods.[10]

Gajdusek indicates that, using a slow static stretch increases the flexibility of hamstring muscle. Bandy et.al examined different durations of static stretching that performed five days per week for six weeks. They examined the effects of hamstring muscle. Stretching across variety of durations include comparing groups with stretch of 15, 30 and 60 seconds to a controlled group that did not stretch. The results indicates that 30 and 60seconds of static stretching were more effective at increasing hamstring muscle flexibility than stretching for 15 seconds or not stretching at all. [2]

Comparing static and PNF stretching of the hamstring muscle to determine if either any effect on muscle performance had; flexibility gains made with no difference noted in the type of stretch used.[11] No significant difference in muscle elongation with PNF stretching compared to passive stretching[1]. A study to evaluate the effect of 10 minutes stretch on muscle stiffness in subjects with short hamstrings has shown that one session of static stretching does not influence the course of the passive muscle stiffness curve.[12] Better stretching technique for the improvement of the range of motion is static stretching in which the limb moved slightly behind the terminal position slowly and then maintained in that position for at least 30 seconds. Moving the limbs slowly decreases the response of the type (Ia) sensory

neuron input allowing minimal interference to the joint movement.[13] A study suggests that duration of 30 seconds is an effective time for stretching in enhancing the flexibility of hamstring muscle.[14] A study compared static stretch and PNF techniques while maintaining the pelvis in two testing positions. Anterior pelvic tilt or posterior pelvic tilt. The hamstring flexibility assessed with the hip position at 90 degrees while actively extending the knee. The result shown that there was no significance difference between static and PNF stretching technique in anterior pelvic tilt position or the posterior tilt position. Again, the study suggests that anterior tilt position was more important for stretching method.[15]

The aims of the study was to analyze the effect of static stretching, analyze the effect of PNF stretching, and to compare the effect of static versus PNF (Contract relax with agonist contraction) stretching on hamstring flexibility.

MATERIAL AND METHODS

Cross-sectional, comparative study, counterbalanced, repeated-measures design

Inclusive criteria:

1. Subjects with hamstring tightness of an average grade according to sit and reach box grading.
2. Subjects with a positive test for 90-90 straight leg raise test, well's sit and reach test, tripod sign.
3. Subjects with SLR below 70-90 degrees.

Exclusion criteria:

1. History of low back pain with sciatica or sacroiliac strain.
2. Injuries of knee such as meniscal tears, ligaments and joint capsule.
3. Deformities of knee joints such as genu valgum, varum or recurvatum.
4. Sharp acute pain, recent haematoma of knee or hip and any acute inflammatory conditions.
5. Osteoarthritis of knee and any infective hip conditions.
6. Patients with neurological impairments having hamstring tightness.

Instrumentation:

1. Examination table
2. Goniometer
3. Measuring tape
4. Sit and Reach box
5. Towel and Pillows

Procedure:

Static stretching:

Double hamstring stretch - Subject sitting on the floor with legs straight and reach forward to touch the toes, curling evenly through the whole of spine. This position maintained for at least 30 seconds and repeated for three times subsequently.

Single-leg or hurdlers stretch for hamstrings; Subject in sitting, one leg extended, and the opposite leg abducted at the hip and flexed at the knee; to allow the foot to rest on the inside of the other leg, and attempts to grasp as far down the leg as possible which stretches the hamstrings; maintaining this position and holding the stretch for at least 30seconds, for both legs consequently and repeated 3 times.

Contract - relax with agonist contraction:

- The subject in supine lying with knee joint extended
- The lower extremity passively flexed by the therapist to full flexion until the limitation is felt
- Once the end range of motion is attained, the therapist asks the patient to attempt to perform concentric contraction of the opposite muscle to the muscle being stretched causing more of stretch. The subject asked to flex actively the hip further to increase the stretch on the hamstring muscle
- In any synergistic muscle group, a contraction of the agonist causes a reflexive relaxation of the antagonist muscle allowing the antagonist muscle to relax for a more effective stretch (reciprocal inhibition)
- Keeping the limb in the new stretch position, the therapist asks the subject to relax and hold the position for 10 seconds and stretch for 10 seconds, and repeated for 3 times.

Data analysis:

The total number of subjects N = 30 randomly divided into experimental(PNF) N = 15 and for control group (Static) N = 15. Both groups individuals were with mean age of20-30 years taken. The data analyzed by using paired t-test to compare the significance of difference in pre and post treatment scores within the groups. Unpaired t-test used to compare the significance of difference in pre-pre and post-post treatment scores between the groups. Using statistical package SPSS, scores obtained using Goniometer tabulated in terms of mean, standard deviation.

RESULTS

As results show from data and statistical analysis:

In flexion, subjects with PNF showed improvement of9.27 ± 1.91 on the right side and 9.53 ± 2.42 on the left side, the STATIC stretching produced mean & SD improvement 7.8 ± 2.91 on right side&7.47 ± 1.96 on left side respectively.

In internal rotation, subjects with PNF showed improvement of 8.4±2.380nthe right side and 7.07±1.530n the left side, the STATIC stretching produced mean & SD improvement 5.73±2.31on right side&6.33 ± 2.550n left side respectively.

In Adduction, subjects with PNF showed improvement of0.13 ± O.520n the right side and O.27±0.590n the left side, the STATIC stretching produced mean & SD improvement 2.4±1.84 on right side&2.87±2.8 on left side respectively. For more detail see tables No (1and 2).

Table-1: Mean and SD of PNF

Movement	Flexion		Extension		Internal rotation		External rotation		Abduction		Adduction	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Right	9.27	1.91	1.94	1.87	8.4	2.38	6.87	2.36	0.27	0.46	0.13	0.52
Left	9.53	2.42	1.27	1.98	7.07	1.53	7.13	1.99	0.27	0.59	0.27	0.59

Table-2: Mean and SD of static group

Movement	Flexion		Extension		Internal rotation		External rotation		Abduction		Adduction	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Right	7.8	2.91	2.2	2.14	5.73	2.31	5.53	2.64	1.27	1.94	2.4	1.84
Left	7.47	1.96	3.07	2.94	6.33	2.55	6.4	3.16	1.00	1.96	2.87	2.8

DISCUSSION

This study done to analyze the improvements in the flexibility of hamstrings by using PNF stretching in comparison with static stretching.

Hamstring muscles are more prone for tightness because of prolonged periods of sitting in this modern sedentary life style. Though by itself will not cause functional limitation unless very severe, it indirectly affects postural mechanics of the pelvis & the lower vertebral column. Furthermore, it can also cause pathokinamatic movement in the knee joint. It is because of this indirect implication that any patient with low back pain or knee joint pain should evaluated and treated for hamstring tightness.

Stretching means lengthening the shortened tissue to their optimal length. It has to emphasize that tight muscle also is a weak muscle & because it has deficits in its viscoelastic properties, it is predisposed to injury & hence stretching is mandatory. It is also important that the treatment be optimal to its maximal efficacy, to allow quick return to nom1al functional length.

Many methods of stretching have put forward and most of them compared as against static stretching. In this study, the method of PNF utilized to promote flexibility of Hamstrings in normal individual. It should note that tight hamstrings would cause a direct limitation in hip flexion and abduction.

T-test performed to analyze the significance of improvements present between static and PNF stretching. The values clearly indicated that most of the patients who were dominant on right side displayed more tightness, than non-dominant side (left side) due to causes not clearly demonstrated.

Conjunction with this, the non-dominant side also has a greater mean improvement in hip flexion and significant p-values. The other movement shown significant changes was adduction. Both these movements showed significant improvement, when PNF was used at p=0.05. Not all other movements as expected had any significant variation between these two techniques.

CONCLUSION

Static and proprioceptive neuromuscular facilitation stretching. Both static and proprioceptive neuromuscular facilitation stretching caused similar closer relations but PNF contract relax-agonist contraction make better significant improvement. The effect sizes, however, corresponding to these stretching-induced changes were small, which suggests the need for practitioners to consider a risk-to-benefit ratio when incorporating static or proprioceptive neuromuscular facilitation stretching.

Future studies should have large sample size subjects with both genders and with multiple age groups. This will give more clear and discrete conclusion about the efficacy of any given stretching techniques thereby aiding treatment optimization.

REFERENCES

1. Reid C David. Sports injury assessment and rehabilitation. Churchill living stone. 1992.
2. Bandy D William. Therapeutic exercises, techniques for intervention, Lippincott Williams and Wilkins (Pub). 2001.
3. Morris M Christopher. The complete guide to stretching. A & amp;C Black. Ltd. 1999.
4. Kuo L, Chung W. Hamstring index, Journal of paediatric orthopedics. 1997; 17 (1); 78-88.
5. Brosseau L, Balmer S, Tousignant M, O'Sullivan JP, Goudreault C, Goudreault M, Gringras S. lntra and Inter tester reliability and criteria on validity of the parallelogram and Universal goniometers for measuring maximum active knee flexion and extension of patients with knee restrictions. Archives Physical medicine Rehabilitation. 2001;82(3):396-402.
6. Halbertsma P.K. Extensibility and stiffness of the hamstring in patients with Non-specific low back pain. Archives Physical medical rehabilitation. 2001; 82(2):232-8.
7. Under Mann E Brian. Pelvic restraint effect on lumbar gluteal and Hamstring muscle electromyographic activation. Archives Physical Medicine rehabilitation. 1999; 80(4):428-31.
8. Magnusson S P. Viscoelastic response to repeated static stretch in human Hamstring muscle. Scandinavian Journal of medicine and Science in sports. 1995;5(6):342-347.
9. Magnusson S.P. Biomechanical response of repeated stretches in human hamstring muscle in Vivo, American Journal of Sports medicine. 1996; 25 (5);:622-628.
10. Vivian H. Advanced fitness Assessment and Exercise prescription.2nd edition;1991.
11. Andrews R Ames, Gary L. Harrelson, Kevin E. Wilk. Physical rehabilitation of injured athlete. 4th edition; 2012.
12. Halbertsma. J. P. K. Effect of passive muscle stiffness of short hamstring. Archives of physical medicine and rehabilitation.1996;77:(7) 688-692.
13. Hamill Joseph. Biomechanical bases of human movements. Second edition. Lippincott Williams and Wilkins. Pub. 2003.
14. Bandy W, B. The effect of time on static stretch on the flexibility of the hamstring muscle.Journal of Physical Therapy.1994; 74 (9):845-850.
15. Sullivan, M.K, and Dejulio J.J. Effect of pelvic position and stretching method on hamstring muscle flexibility. Med Sci Sports Exerc .1992; 24(12):1383-9.

Citation
Karnati, V., & Ali Mohammed, A. (2015). STATIC VERSUS PNF STRETCHING IN HAMSTRINGFLEXIBILITY-A COMPARITIVE STUDY. *International Journal of Physiotherapy*, 2(3), 513-517.