IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 14, Issue 4 Ver. X (Apr. 2015), PP 12-16
www.iosrjournals.org

A Comparison between Two Active Stretching Techniques on Hamstrings Flexibility in Asymptomatic Individuals

Babina Rani[1], P P Mohanty[2]
1.Asst.Professor, College of Physiotherapy, MAMC, Agroha, Hisar, India
2. Head OfDeptt, Deptt of Physiotherapy, SVNIRTAR, Cuttack, India

Abstract

***Background**: Lack of hamstrings flexibility has been reported to be one of the most important factors contributing to hamstrings injury during high-speed and high-intensity exercise. Active stretching of hamstrings has been found to be more beneficial than passive stretching after 4 weeks.*

***Objective**: To compare the effects of two active stretching techniques- modified hold relax technique of PNF and neural mobilization as described by Butler, for improving the flexibility of hamstrings.*

***Methods**: 60 asymptomatic male subjects were included based on inclusion and exclusion criteria. Baseline measurement of AKE loss was taken for right leg.The subjects were then randomly divided into two groups, who were then given either Hold –relax or Neural mobilization technique to improve hamstringsflexibility.Post-test measurement was repeated after 4 weeks of intervention.*

***Results**: Results showed a significant increase in hamstrings flexibility achieved with both the techniques (p= 0.000 for both neural mobilization and hold-relax). The mean gain in AKE achieved after 4 weeks was $11.70^0 \pm 4.32^0$ with neural mobilization, and $11.80^0 \pm 3.08^0$ with hold-relax. Both techniques were found to be significant but the comparison revealed no statistically significant difference between these two techniques. (p-value = 0.953).*

***Conclusion**: Both hold-relax and neural mobilization are equally effective in improving hamstrings flexibility in normal adults.*

***Keywords**: hamstrings, stretching, hold relax, neural mobilization.*

I. Introduction

Flexibility is a key component for injury prevention. Flexibility of muscle is "the ability of a muscle to lengthen, allowing one joint (or more than one joint in a series)[34] to move through a range of motion" leading to more efficiency and effectiveness in movement which assist in preventing or minimizing injuries, & muscle soreness[1, 2].Many factors influence an individual's flexibility including age, race, gender, tissue temperature, circadian rhythms, strength training, stiffness and warm-up.

Hamstring and fascia tightness is common in asymptomatic healthy individuals leading to back pain & reduced performance level.[4, 30] Also, Hamstring strains are a common athletic injury with a tendency to recur[1, 33], the main predisposing factors being lack of flexibility[17, 18, 32]&adverse neural tension.[26]Hamstring strains insprinters and athleteswho performhigh-speed skilledmovements arecommon injuries and pose complicatedrehabilitation challenges, especiallywhen returning athletesquickly and safely to sports participation.[1, 18]

The active knee extension (AKE) test (in 90/90 position) has been widely reported in the literature as an indicator of hamstring muscle length.[12]A variety of stretching techniques aiming to improve the muscle length include the ballistic stretch, the static stretch, proprioceptive neuromuscular facilitation & modified PNF.[3,6,11, 16]Stretching is commonly employed in all kinds of sports and athletic events, because muscle length is known to affect the contractileproperties of muscle, and shortened or lengthened musclesmay not develop maximal tension if their resting length hasbeen altered.[15] Moreover, stretching exercises are commonlyrecommended for the prevention of lower extremity injuries.

Literature supports the view of active stretching being more favorable than passive as far as improving the muscle flexibility is concerned. A 6 week program of active stretching has been shown to produce the greater gain(of 8.7^0) in the AKE test than the passive stretching group (mean gain of 5.3^0)(p=0.006) and maintained till 4 weeks of no stretching.[21]Sady et.al (1982)[24] found PNF stretching to be more beneficial than static (or passive) stretches[8,14]and ballistic stretching in gaining hamstrings flexibility.[6]Comparing the two PNF techniques, Nagarwal et.al (2010) have concluded in their study that both the techniques viz. PNF Hold Relax and PNF-CRAC are almost equal in their clinical effectiveness for improving hamstring flexibility.[23]

Impaired neural mobility is associated with motor control dysfunction.[22]To enhance motor control which is directly related to flexibility in joints, the nerve has to glide adequately at the nerve-muscle interface.Use of active nerve glide stretches has been advocated as effective means for increasing flexibility of adjoining muscles[10], thereby increasing the ROM, yet there is paucity of published data to support the view.Kornberg and Lew (1989) have suggested that adding the slump maneuver to a treatment regime improved the flexibility and facilitated an athlete's return to full function after a grade I hamstring strain.[19, 20]
There is paucity of literature comparing the effectiveness of active stretching techniques, so this study aimed to compare the efficacy of two such active (PNF modified hold-relax and neural mobilization) techniques to improve hamstring muscle length.

II. Methodology

This is a pretest post- test experimental study design, in which 60 asymptomatic male subjects of age range 23-27 (mean age: 24.5 $\pm$ 1.19yrs) were conveniently selected based on inclusion and exclusion criterion & then randomly allocated to either of the 2 groups.The study was conducted at approximately the same time every day, to avoid discrepancies related to change in muscle length with the time of the day.

Inclusion criteria: 20-30 year old males, having Active knee extension loss of $\geq 20^0$ (with subjects in supine; hip 90^0 flexed) on right side(arbitrarily chosen) lower limb.Subjects should have quadriceps muscle strength of 5 on both sides. Exclusion criteria included any previous trauma to the lower limb on tested side, history of LBP, Piriformis syndrome, any musculoskeletal pathology to tested LL, Subjects with athletic background, Hypermobility (initial hamstrings length > 90^0).

Pre-test measurement for AKE angle loss was taken in following manner (figure 1). The patient performed a total of 6 AKEs with a 1-minute rest period in between.The active knee extension (AKE) test was measured with hip flexed to 90^0, using half-circle goniometer.The first 5 AKEs were considered as warm-upsto decrease any effect that may occur withrepeated measures performed from a cold start[7], 6th AKE was taken asbaseline measurement. There was a 60-sec rest period between reps. The stationary arm of the goniometer was placedalong the lateral femur, and the moving arm was aligned withthe lateral fibula. Subjects extended the knee to the limit ofmotion. The number of degrees from full extension wasrecorded. The post-stretch measurement was taken after 4 weeks of treatment.[27]

a) b)

Figure 1. The AKE measurement

Group 1 was given modified Hold- relax (PNF) technique**.**[27]The Hamstring muscle was passively stretched until subject first reports a mild stretch sensation, this was given a hold for 7sec, followed by maximal isometric contraction of hamstring against resistance for 7 sec.After contraction, subject will relax for 5sec, again passively stretch the muscle until a mild stretch sensation is reported, again for a hold of 7 sec.This was repeated for 5 times/session, 5 sessions/week once daily, for 4weeks.

Group 2 was given neural mobilization as given by Butler.[5]Thetechnique was performed with knee completely extended and femur as close to perpendicular as possible. With hip in adduction & internal rotation, and with passive neck flexion, the subject did active pumping by dorsiflexing and plantarflexing the foot 30 times for3 sets/session. Both groups received stretching for 5days/week for 4 weeks.

Data Analysis

The dependent variable (AKE angle loss) was analyzed using 2 x 2 ANOVA with repeated measures of the second factor. There was one between factor (group) with two levels (hold relax and neural mobilization group), and one factor (time) with two levels (pre, post). Pair-wise post-hoc comparisons were done using a 0.05 level of significance.

III. Results

The mean gain in AKE achieved after 4 weeks was $11.70^0 \pm 4.32^0$ with neural mobilization, and $11.80^0 \pm 3.08^0$ with hold-relax.There was a main effect for the time $F(1,18,0.05)=195.911$ ($p=0.000$), group $F(1,18,0.05)= 2.881$ ($p=0.000$), but group X time was not significant $F(1,18,0.05)= 0.007$ ($p=0.953$). (figure 2)The post-hoc revealed no statistically significant difference between the two groups.

IV. Discussion

Gains in flexibility of both training groups were observed, indicating that flexibility of the hamstrings can be improved effectively by both protocols. The improvement in hold relax technique may be attributed to the fact thattension in the muscle produces autogenic inhibition through activation of groupIbfibres, thereby, inducing muscle relaxation of the tight muscle. There is also passive elongationof muscle and fascia as the joint moves in the opposite direction after the muscle relaxes from maximal isometric contraction. And this is quite consistent with the findings proposed by Nagarwal et.al (2010).[23]The mechanism for this gain in flexibility could also be the change in stretch perception or tolerance, as has been proposed by Sharman MJ et.al in (2006).[25]Hutton proposed that during PNF stretching it is likely that the pre-stretch conditioning contraction (the hold phase of HR stretching) loosens the thixotropic bonds decreasing muscle stiffness via manipulation of the myogenic component rather than the neurogenic component. The studies of similar PNF stretching techniques

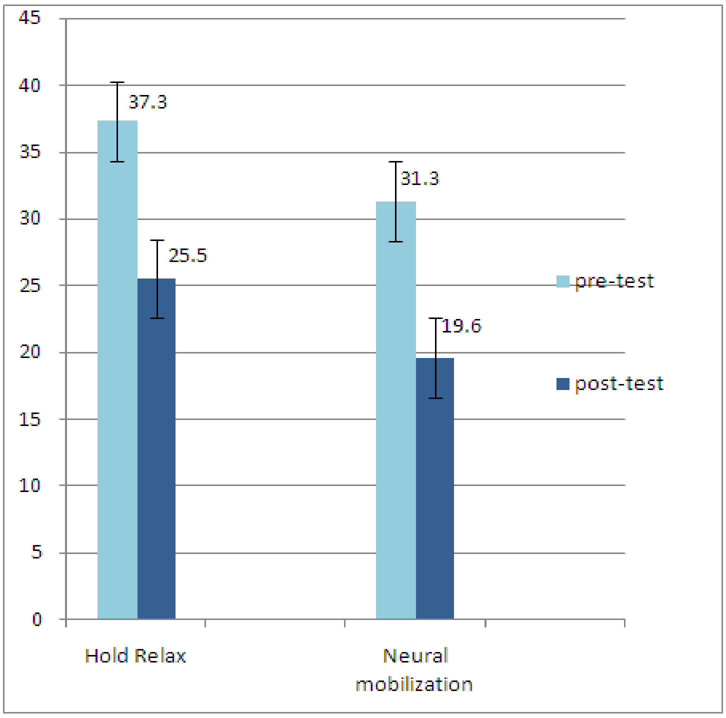

Figure 2. Active knee extension angle loss - Results

suggest that autogenic inhibition of the stretched muscle provides increasedROM.[9,28,31]Musculotendinous units function in a viscoelastic manner,and, therefore, have the properties of creep and stress relaxation. The improvement in hamstringflexibility may be attributed to changes in the elasticregion caused by a single session of hold-relax stretching.[29]The improvement with neural mobilization may likely be explained for the fact that the nerve tissue is stressed at the extreme of joint position (i.e. in a direction of movement produced by tight muscle), wherein the muscle and fascia are also maximally elongated. When neural tissues, which pass through the tight muscle, are mobilized, the restriction to mobility faced at interface of nerve and muscle are overcome and the flexibility of nerve-muscle unit increases. More the nerve is manipulated, more is the movement at the mechanical interface & more is the flexibility (excursion). Results of the study are consistent with those of Fasen et.al (2009) - flexibility is influenced not only by muscle elasticity but also by connective tissue/nervous tissue extensibility.[10]

Gajdosik[11] pointed out thatalong with the hamstrings, the deepfascia of the lower limb and the softtissues of the pelvis, including neurologictissue[4,13, 30] could limit astraight leg raise test. In the sameway, these non-contractile tissues cancome under tension during passiveor active movements of hip flexion orknee extension. If tension of non-contractiletissue limits indirect measuresof hamstring flexibility, i.e., straightleg raise or active knee extensiontests, then use of a stretching techniquethat emphasizes these tissues,along with the hamstrings, may be justified.

Use of active knee extension movement in neural mobilization helps to effectively tension the neural and hamstrings tissues, thus preventing any hamstrings strain resulting from abnormal neural retraction. Increased flexibility resulting from both these techniques may decrease the incidence of musculotendinous injuries, minimize and alleviate muscle soreness, & improve athletic performance

V. Conclusion

Both the techniques (modified hold relax & neural mobilization) were found equally effective in improving the hamstrings flexibility. Although hold relax is universally practised as a method of stretching, the latter is equally effective for gaining hamstrings flexibility, plus the advantage that it can be practised independently by patient with minimal assistance. So neural mobilization can also be an effective tool for the same. Further study can be carried out checking the implications of same in athletic and patient population, with a room for long term follow up.

References

[1]. Agre JC: Hamstring injuries: Proposed etiological factors, prevention and treatment. Sports Med 2:2 1-33, 1985

[2]. Anderson, Burke ER: Scientific, medical, and practical aspects of stretching.Clin Sports Med 10:63-86, 1991

[3]. Bandy WD, Irion JM, Briggler M. The Effect of Static Stretch and Dynamic Range of Motion Training on the Flexibility of the Hamstring muscle. J Orthop Sports PhysTher. 1998;27:295–300.

[4]. Breig A, Troup JOG: Biomechanical considerations in the straight leg raising test: Cadaveric and clinical studies of the effects of medial hip rotation. Spine 4:242-250, 1979.

[5]. Butler D, Matheson J, Boyaci A. The Sensitive Nervous System. Adelaide City West, South Australia: The NOI Group; 2000.

[6]. Ciullo JV, Zarins 6: Biomechanics of the musculotendinous unit: Relation to athletic performance and injury. Clin Sports Med 2:71-86, 1983

[7]. DePino GM, Webright WG, Arnold BL. Duration of maintained hamstring flexibility following cessation of an acute static stretching protocol. J Athl Train. 2000;35:56–59

[8]. Devries, HA. Evaluation of static stretching procedures for improvement of flexibility. Res Q 33: 222–229, 1962.

[9]. Etnyre BR, Abraham LD: H-reflex changes during static stretching and two variations of proprioceptive neuromuscular facilitation techniques. Electroencephahalography and Clinical Neurophysiology 63: 174-179, 1986

[10]. Fasen JM, Annie M O'Cannor, Schwartz SL,et.al. A randomized controlled trial of hamstring stretching: comparison of four techniques. J Strength Condit & Res 2009.23(2):660-7.

[11]. Gajdosik RL: Effect of static stretching on the maximal length and resistance to passive stretch of short hamstring muscles. J Orthop Sports PhysTher l4:250-255,1991

[12]. Gajdosik R, Lusin C: Hamstring muscle tightness: Reliability of an active-knee extension test. PhysTher 63:1085- 1088, 1983

[13]. Goddard MD, Reid ID: Movements induced by straight leg raising in the lumbo-sacral roots, nerves and plexus, and in the intrapelvic section of the sciatic nerve. J NeurolNeurosurg Psychiatry 28: 12- 18, 1965

[14]. Godges, JJ, Macrae, H, Longdon, C, Tinberg, C, and Macrae, P. The effect of two stretching procedures on hip range of motion and gait economy. J Orthop Sports PhysTher 10: 350–357, 1989.

[15]. Gossman MR, Sahrmann SA, Rose SJ. Review of length-associated changes in muscle: experimental evidence and clinical implications. PhysTher. 1982;62:1799–1808.

[16]. Halbertsma JP, Goeken LN. Stretching exercises: effect on passive extensibility and stiffness in short hamstrings of healthy subjects. Arch Phys Med Rehabil. 1994;75:976–981.

[17]. Hutton RS: Neuromuscular basis of stretching exercise. In: KomiPV (ed), Strength and Power in Sports, pp 29-38. Oxford: Blackwell Scientific Publications, 1993

[18]. Jonhagen S, Nemeth G, Eriksson E. Hamstring injuries in sprinters: the role of concentric and eccentric hamstring muscle strength and flexibility. Am J Sports Med. 1994;22:262-266.

[19]. Kornberg CM: The incidence of positive slump test in Australian rules football players with grade one hamstring strain. Proceedings of the 10th International Congress. WCPT. Sydney. Book 11: 1060- 1064.1987

[20]. Kornberg, C and Lew, P. The effect of stretching on neural structures on grade one hamstring injuries. J Orthop Sports PhysTher 13: 481– 487, 1989.

[21]. Meroni R, Lanzarini C, Barrindeli Guido et.al. Comparison of active stretching technique and static stretching technique on hamstring flexibility. Clin J Sport Med 2010;20:8–14

[22]. Michael Shacklock. ClinincalNeurodynamics: A New System of Musculoskeletal treatment. Butterworth Heinemann. Toronto 2005

[23]. Nagarwal A.K, Zutshi K, Ram C S, Zafar R. Improvement of hamstrings flexibility : a comparison of two PNF stretching techniques. International J of Sports Science & Engineering. 4(1):25-33, 2010

[24]. Sady SP, Wortman M, Blanke D. Flexibility training: ballistic, static or proprioceptive neuromuscular facilitation. Arch Phys Med Rehabil. 1982;63:261-263.

[25]. Sharman MJ, Cresswell AG, Riek S. Proprioceptive Neuromuscular facilitation stretching : mechanisms and clinical implications. Sports Med 2006; 36(11):929-39

[26]. Sharon E. Turl, Keithe P. George. Adverse neural tension: A factor in repetitive hamstrings strain? J Orthop Sports PhysTher 27(1):16-21,1998
[27]. Spernoga SG, Uhl TL, Arnold BL, Gansneder BM. Duration of maintained hamstrings flexibility after a one-time, modified hold-relax stretching protocol. J Athl Train 36(1):44-48,2001
[28]. Tanigawa MC. Comparison of the hold-relax procedure and passive mobilization on increasing muscle length. PhysTher. 1972;52: 725–735.
[29]. Taylor, DC, Dalton, JD, Seaber, AV, and Garrett, WE. Viscoelastic properties of muscle-tendon units. The biomechanical effects of stretching. Am J Sports Med 18: 300–309, 1990
[30]. Troup JDG: Straight leg raising and the qualifying tests for increased root tension. Spine 6:526 -527, 1981
[31]. Voss DE, lonta MK, Meyers BJ: Proprioceptive Neuromuscular Facilitation (3rd Ed) pp 304-306, Philadelphia: Harper and Row, 1985
[32]. Worrell TW, Perrin DH, Gansneder BM, Gieck JH. Comparison of isokinetic strength and flexibility measures between hamstring injured and noninjured athletes. J Orthop Sports PhysTher. 1991 ;13: 118-125.
[33]. Worrell TW, Perrin DH. Hamstring muscle injury: the influence of strength, flexibility, warm-up, and fatigue. J Orthop Sports Phys Ther.1992;16:12-18.
[34]. Zachezewski JE: Improving flexibility. In: Scully RM, Barnes MR (eds), Physical Therapy, pp 698-699. Philadelphia,PA: 1.6. Lippincott Company, 1989.