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

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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 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 hamstrings flexibility. 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° ± 4.32° with neural mobilization, and 11.80° ± 3.08° 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) to move through a range of motion” leading to more efficiency and effectiveness in movement which assist in preventing or minimizing injuries, & muscle soreness. 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. Also, Hamstring strains are a common athletic injury with a tendency to recur, the main predisposing factors being lack of flexibility & adverse neural tension. Hamstring strains in sprinters and athletes who perform high-speed skilled movements are common injuries and pose complicated rehabilitation challenges, especially when returning athletes quickly and safely to sports participation.

The active knee extension (AKE) test (in 90/90 position) has been widely reported in the literature as an indicator of hamstring muscle length. A variety of stretching techniques aiming to improve the muscle length include the ballistic stretch, the static stretch, proprioceptive neuromuscular facilitation & modified PNF. Stretching is commonly employed in all kinds of sports and athletic events, because muscle length is known to affect the contractile properties of muscle, and shortened or lengthened muscles may not develop maximal tension if their resting length has been altered. Moreover, stretching exercises are commonly recommended 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°) in the AKE test than the passive stretching group (mean gain of 5.3°)(p=0.006) and maintained till 4 weeks of no stretching. Sady et.al (1982) found PNF stretching to be more beneficial than static (or passive) stretches and ballistic stretching in gaining hamstrings flexibility. 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.
Impaired neural mobility is associated with motor control dysfunction. 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, 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. 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-posttest experimental study design, in which 60 asymptomatic male subjects of age range 23-27 (mean age: 24.5 ± 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 >20° (with subjects in supine; hip 90° 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°).

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°, using half-circle goniometer. The first 5 AKEs were considered as warm-up to decrease any effect that may occur with repeated measures performed from a cold start, 6th AKE was taken as baseline measurement. There was a 60-sec rest period between reps. The stationary arm of the goniometer was placed along the lateral femur, and the moving arm was aligned with the lateral fibula. Subjects extended the knee to the limit of motion. The number of degrees from full extension was recorded. The post-stretch measurement was taken after 4 weeks of treatment.

Group 1 was given modified Hold-relax (PNF) technique. 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 4 weeks.

Group 2 was given neural mobilization as given by Butler. The technique 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 for 3 sets/session. Both groups received stretching for 5 days/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° ± 4.32° with neural mobilization, and 11.80° ± 3.08° 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 that tension in the muscle produces autogenic inhibition through activation of group I fibres, thereby, inducing muscle relaxation of the tight muscle. There is also passive elongation of 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). 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). 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 suggest that autogenic inhibition of the stretched muscle provides increased ROM. Musculotendinous units function in a viscoelastic manner, and, therefore, have the properties of creep and stress relaxation. The improvement in hamstring flexibility may be attributed to changes in the elastic region caused by a single session of hold-relax stretching. 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

Gajdosik11 pointed out thatalong with the hamstring, the deepfascia of the lower limb and the softtissues of the pelvis, including neurologictissue6, 13, 30 could limit a straight leg raise test. In the same way, these non-contractile tissues can come 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 extensionstests, 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

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