COMPARISON OF ACTIVE ISOLATED STRETCH AND POST ISOMETRIC RELAXATION FOR IMPROVING HAMSTRING FLEXIBILITY IN YOUNG HEALTHY ADULTS

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ABSTRACT

Objective: To compare the immediate, short term and long term effects of active isolated stretch versus post isometric relaxation on hamstring flexibility in young healthy adults.

Study Design: Randomized controlled trial **(trail number is NCT04024839).**

Place and Duration of Study: Islamabad Federal College, in the department of Doctor of Physical Therapy from Jan 2018 to Jul 2018.

Methodology: Thirty five students were selected according to inclusion criteria and randomly assigned into two groups by lottery method 17 and 18 in each group respectively. Group A was given post isometric relaxation while group B was active isolated stretch. Age group between 18 to 25 year, male and female students with tight hamstring were included while neurological and orthopedic disorders were excluded. Active Isolated Stretch and Post Isometric Relaxation at baseline, after first and final exercise session were calculated immediately and short term effects while long term effects were calculated after two weeks of final session.

Results: Active knee extension score for both hamstring muscles after 1st session showed statistical insignificant improvement for both legs (p=0.20 right and p=0.18 left). Active knee extension score after 2 weeks of exercises gave insignificant improvement in score for both legs (p=0.20 right and p=0.20 left). Similarly, Active Knee Extension score after all sessions showed insignificant improvement for both legs (p=0.49 right and p=0.88 left). There was no significant improvement for Active Knee Extension, lower extremity scale and sit and reach test with p=0.15. There were no differences between the effectiveness of both techniques i.e., Passive Isometric Relaxation and Active Isolated Stretch (p=0.58).

Conclusion: Both techniques were equally effective in their immediate, short-term and long term effects on hamstrings flexibility.

Keywords: Active isolated stretch, Hamstring muscle tightness, Lower extremity functional scale, Post isometric relaxation.

INTRODUCTION

Hamstring muscle is present on posterior region of thigh starting from gluteal region and ending in popliteal fossa. Hamstring has three muscles: biceps femoris, semitendinosus and semimembranosus causing flexion at knee joint and help in extension of thigh[1]. Biceps femoris further consists of two heads (long and short head). Long head is supplied by tibial part of the sciatic nerve, while short head is supplied by the common peroneal part of the sciatic nerve[2]. Muscles such as gastrosoleus, tibialis posterior, rectus femoris, iliopsoas, tensor fasicalata, the hamstrings and hip adductors are more likely to be tightened in lower limbs. Muscle tightness can cause the muscle shortness and does not allow full passive or active range of motion. Full active and passive range of motion is only achieved when muscle is flexible[3].

Tightness of hamstring muscle can occur due to many reasons like injury to the muscle, prolonged sitting hours which are part of different jobs and educational setups. This tightness could lead to strain of the hamstrings, which is the most common occurring injury of the lower limbs[4]. Moreover, hamstring tightness is

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also correlated with low back pain and lumbar dysfunction. Massage and stretching relax the tightened muscles but cannot normalize the tone or improve their coordination. To achieve this, we retrain muscle memory by actively using those respective muscles. Simple stretching of different muscle groups especially hamstrings has been found to improve the extensibility and length of shortened muscles[5].

Additionally, Muscle Energy Techniques (MET) and their related post-isometric relaxation techniques have demonstrated better results in improving flexibility of the tightened muscles. MET are used in soft tissue pathologies in which the patient performs active muscle contraction in specific positions and in specific direction against a force applied by the therapist[6]. The therapist guides and controls the movement with instruction. These are manual techniques that use contraction of the specific muscles and are found to be effective in increasing flexibility of the muscles and improving range of motion. The underlying mechanism through which improvement in extensibility and length occurs is yet unclear and thought to be attributed to both mechanical as well as neurological factors[7]. Firstly MET are applied to increase extensibility of the muscles typically involving following steps: stretching the muscle to the limit of barrier or person's tolerance, secondly the person performs an active isometric contraction of the muscle being stretched against a controlled resistance provided by the therapist, additionally the person relaxes the muscle being stretched while the therapist continues holding the stretched position, furthermore the therapist takes up the new range produced by muscle and lengthens it up to a new barrier, and this whole procedure is repeated again according to defined guidelines[8]. MET can be modified with variations in different components such as force of contraction, duration of the contraction, duration of the stretch and repetitions. This whole process results in increased range of motion and improves flexibility[9].

Post Isometric Relaxation (PIR) is a type of MET that relaxes the tight muscles with avoidance of initiating stretch reflex. This in turn results in reduced spasm and improved ROM. The relaxation is induced due to isometric contraction of the muscles with facilitation and inhibition[10]. Active Isolated Stretch (AIS) is another type of stretching in which specific movement is performed for a specific muscle with assistance from a therapist or self-assisted (with rope or a band) and those particular movements are repeated again and again to induce a relaxation phenomenon in muscles, fascia and connective tissues. In AIS, movements are monitored carefully to avoid producing any stretch reflex.

METHODOLOGY

A single blind randomized controlled study was done in Islamabad Federal College Islamabad with a duration of 6 months from January 2018 to July 2018. Calculated total sample size was 35 students with 95% level of confidence by using mean ± SD (130.4 ± 3.8 of group 1 and 136.8 ± 7 of group 2) of the previous study through open epi and divided in to two groups 17 in group A and 18 in group B[11]. Non probability purposive random sampling was done by lottery method on 18-25 year male and female students of DPT with tight hamstring were included by measuring the hamstring muscle length through the straight leg raising (SLR) test while hamstring injury and any neurological or orthopedic disorder were excluded. The study was approved by the Ethical and Research Committee with reference # Riphah/RCRS/REC /00430, and all participants signed the informed consents. Group A was given Post Isometric Relaxation (PIR) while group B was given Active Isolated Stretch (AIS). Active Isolated Stretch and Post Isometric Relaxation at baseline, after first and final exercise session were calculated immediate and short term effects while long term effects were calculated after two weeks of final session between both groups. Semi structured questionnaire was used for subjective and objective assessment. AKE score, sit and reach test score and Lower Extremity Functional Scale (LEFS) questionnaire was used to assess lower extremity

functional activities. Sit and reach test was also used to measure hamstring length. Data was analyzed by SPSS 21 and normality test was applied and data shows non-normally distributed so between groups analysis was performed by using Mann-Whitney U-test for AKE score and LEFS score while independent t-test for sit and reach test.

RESULTS

A total of 35 participants with the mean age of Mean 22.2 ± SD 2.02 years participants were analyzed in both groups. Gender distribution across both groups was also similar 16 (45.7%) males and 19 (54.28%) females in group-A and 14.5 (41.42%) males and 20.5 (58.57%) females in group-B. Participants across both groups were similar of age mean ± SD 22.22 ± 2.02 years in group-A and mean ± SD 22.35 ± 2.06 year in group-B. BMI of the participants were mean ± SD 20.79 ± 2.89 for group-A and mean ± SD 19.61 ± 2.95 for group-B. However, average sitting hours of the participants per day mean ± SD7.89 ± 2.47 and 7.59 ± 2.24 for group-A and group-B respectively, there was a notable difference between two groups for being physically active as 23 (66%) of the participants in group-A were active while only 12 (34%) of the participants from group-B were doing regular physical activity.

Between group analysis results showed that AKE score for both hamstring muscles after 1st session showed statistical insignificant improvement for both legs (p=0.20 right and p=0.18 left). AKE score after 2 weeks of exercises gives insignificant improvement in score for both legs (p=0.20 right and p=0.20 left). Similarly, AKE score after all sessions showed insignificant improvement for both legs (p=0.49 right and p=0.88 left). There was no significant improvement for AKE, lower extremity scale and sit and reach test with p=0.15. There were no differences between the effectiveness of both techniques PIR and AIS (p=0.58). The mean and SD for sit and reach test score were 38.55 ± 9.96,

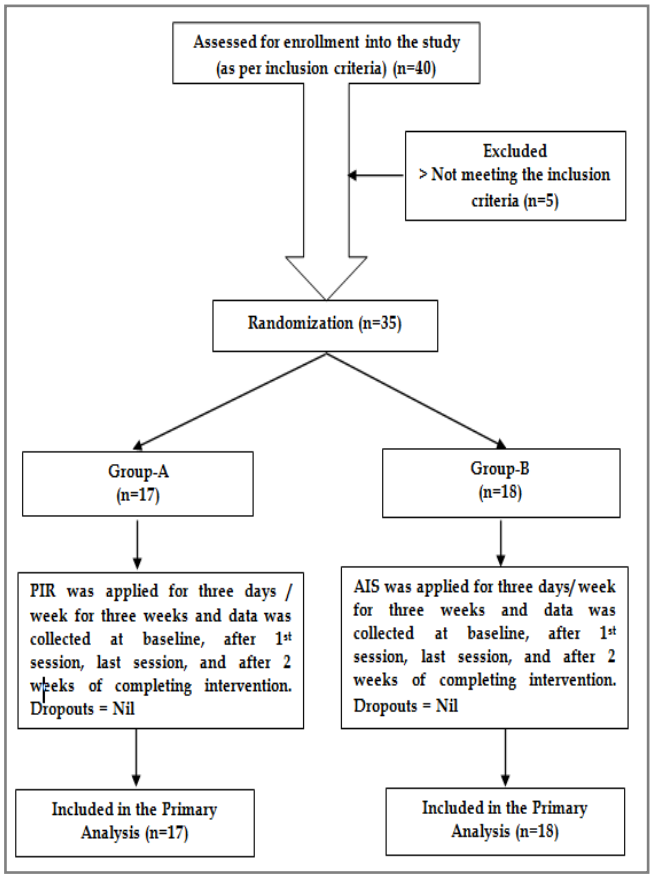

Figure: Patients flow diagram.

Table-I: Comparison of active knee extension score in both groups.

Variables		Median (IQR)		*p*-value*
		Group-A	Group-B	
Active Knee Extension Score (At baseline)	Right Leg	149.50 (7.5)	150.00 (5.5)	0.11
	Left Leg	146.50 (13.25)	150.00 (10)	0.38
Active Knee Extension Score (After 1st Session)	Right Leg	150.00 (13.00)	154.00 (7.50)	0.20
	Left Leg	151.00 (20.00)	152.00 (14.50)	0.12
Active Knee Extension Score (After all sessions)	Right Leg	161.00 (0.50)	158.00 (4.00)	0.49
	Left Leg	162.00 (3.25)	155.00 (15.50)	0.88
Active Knee Extension Score (After 2 weeks of Intervention)	Right Leg	155.00 (15.00)	151.00 (5.00)	0.20
	Left Leg	154.50 (15.00)	150.00 (12.50)	0.20

42.11 ± 10.03, 42.83 ± 9.75 and 43.39 ± 11.19 at baseline, immediately after 1st session, after all treatment sessions and after two weeks of finishing treatment sessions, respectively. LEFS also showed insignificant improvement after finishing all the sessions of intervention with PIR (p=0.80).

The results of analysis for AIS showed that with in group-A (PIR), results showed that AKE score for both hamstring muscles after 1st session showed significant improvement for both legs (p=0.018 for right leg and p=0.004 for left leg). AKE score after all sessions of intervention also showed significant improvement for both legs (p=0.000 for right leg and p=0.000 for left leg). Similarly, after the analysis of data for AKE score after 2 weeks of finishing intervention, results showed significant improvement in score for both legs (p=0.005 for right leg and p=0.005 for left leg. Moreover, results for the sit and reach test showed that PIR was effective in improving the score over different periods of time (p=0.001 immediately after 1st session, p=0.001 after all sessions and p=0.001 after two weeks of finishing all treatment sessions). The mean and SD for sit and reach test score were 38.55 ± 9.96, 42.11 ± 10.03, 42.83 ± 9.75 and 43.39 ± 11.19 at baseline, immediately after 1st session, after all treatment sessions and after two weeks of finishing treatment sessions, respectively. The results for the LEFS also showed significant improvement after finishing all the sessions of intervention with PIR (p=0.000).

The results of analysis for AIS showed that within group-B (AIS) AKE score for hamstring muscle after 1st session showed significant improvement for both legs (p=0.000 right and p=0.000 left). AKE score after all sessions showed significant improvement in both legs (p=0.015 right and p=0.004 left). AKE score after 2 weeks of intervention, results showed insignificant improvement for both legs (p=0.68 right and p=0.68 left). Sit and reach score with paired t-test showed that AIS significantly improved sit and reach score over different periods of time p=0.000 immediately after 1st session, p=0.000 after all sessions and p=0.000 after two weeks of finishing all treatment sessions.

Table-II: Comparison of sit and reach test score in both groups.

Variables	Mean ± SD (Group-A) n=18	Mean ± SD (Group-B) n=17	*p*-value*
Sit & Reach-Test Score (After 1st Session)	42.11 ± 10.03	46.82 ± 8.57	0.146
Sit & Reach-Test Score (After all sessions)	42.83 ± 9.75	47.29 ± 8.30	0.156
Sit & Reach-Test Score (After 2 weeks of Intervention)	43.39 ± 11.19	46.49 ± 7.85	0.355

Table-III: Comparison of lower extremity functional scale score in both groups.

Variables	Median (IQR)		*p*-value*
	Group-A	Group-B	
Lower Extremity Functional Scale (At Baseline)	73.50 (7.25)	70.00 (8)	0.638
Lower Extremity Functional Scale (After 2 Intervention)	74.50 (8.00)	72.00 (7.50)	0.583

The results of data showed that there were no differences between the effectiveness of both techniques: PIR and AIS (p=0.802). This trend was similar for all the variables i.e. AKE score, sit and reach test score, and LEFS score for AKE score, sit and reach test score and LEFS score, respectively.

DISCUSSION

The objective of current study was to compare the effect of active isolated stretch and post isometric relaxation for improving hamstring flexibility in young healthy adults. This study was randomized control trail in which we compared AIS and PIR techniques through AKE-

score, sit and reach test score, and LEFS score. A previous study was conducted by Moore *et al* in 2011 on hamstring flexibility measured their data using AKE scores[12]. The results of this current study showed that during within group comparison PIR improve the flexibility of hamstrings muscles. A study was conducted by Agrawal on 100 college students in 2016 and compared the results of PIR and RI, and he found that PIR was more effective in improving hamstring flexibility[13]. In another study was done by Shadmehr *et al*. in 2009 to assess the effectiveness of PIR in young women and they concluded that PIR was effective in improving hamstrings flexibility[14].

Similarly, Redij *et al* conducted a study in 2017 to compare the effects of PIR stretching technique with muscle energy technique on relaxation of tightened iliopsoas muscle. They also reported that PIR was effective for relaxing the tight muscles. There results showed these effects after three weeks of intervention as there *p*-value was <0.01 in post treatment values as compare to the before exercise plan *p*-value was >0.05. This study however was conducted on the patients with iliopsoas muscle tightness[15] another study was conducted Day and Nitz *et al* in 2012 on hamstring muscles' tightness also reported the results to be of significant value[16]. During the group comparison AIS improve the flexibility of hamstrings muscles. Mattes *et al* conducted a study and introduced these techniques has reported in 2001 that AIS was effective in reducing tightness of hamstrings *p*-value <0.05[17].

Additionally, current study also investigated the functional aspect of these techniques by using LEFS score. Results also showed significant improvement in LEFS scores in both groups. These results are in accordance with another study conducted by Horng YS, Hou WH, *et al* in 2019 of the effectiveness of PIR as results shows that *p*-value was <0.01 in experimental group especially in LEFS score[18]. There was no statistical significant difference ($p>0.05$) between the results of both techniques. Talapalli and Sheth *et al* in 2014 has reported mixed results for PIR techniques like reciprocal inhibition (RI) had superior effects than PIR on muscle flexibility[19]. Another study was done by Channell and Wang *et al* in 2016 and found that PIR was more effective in reducing hamstrings muscle tightness than RI ($p<0.05$). Therefore, given the large number of population having hamstrings muscle tightness and decreased ROM, these techniques can be used effectively to reduce the detrimental effects of muscle tightness[20].

CONCLUSION

Both techniques were equally effective in their immediate, short-term and long term effects on hamstrings flexibility and no one was superior in comparison with the other.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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