

Randomized Controlled Trial Comparing the Effectiveness of Post Isometric Relaxation versus Static Stretching in Lower Limb Flexibility among Asymptomatic Healthy Individuals

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Abstracts: Purpose: The objective of this study was to observe the effectiveness of Post isometric relaxation versus static stretching in lower limbs among asymptomatic healthy individuals. Methods: This randomized controlled trial study was carried out in students of Shifa Tameer e Millat University from December 2021 to July 2022. 49 participants of both genders were included through non probability convenient sampling on the basis of inclusion criteria of both genders with age range of 18-25years. Participants with any history of any trauma, fractures, meniscal injuries, systemic illness and any lower limb musculoskeletal deformities were excluded from the study. A self-structured questionnaire was used to obtain demographics; a standard questionnaire; Lower Extremity Functional Scale (LEFS) and outcome measures; active knee extension, straight leg raise, standard sit and reach and finger to floor distance tests were used. The participants were divided into two groups, Group A received post isometric relaxation technique and Group B received static Stretching. The data collected was analyzed by using SPSS software version 21. Results: The mean age of participants in Post Isometric Relaxation group was 22.083±1.44 and 21.72±1.62 in Static Stretching group. The with group analysis showed significant results as p value was less than 0.05. Whereas for between group analysis p value was greater than 0.05 so no significant improvement was observed at post level. Conclusion: The current study concluded that no treatment technique was superior than the other as both were equally effective for hamstring flexibility in asymptomatic individuals.

Keywords: Post Isometric Relaxation, Static Stretching, Comparable Effectiveness, Hamstring Flexibility.

1. INTRODUCTION

The group of hamstring muscle consisted of three different muscles and a very essential role is played by this muscular complex during daily human activities like standing to explosive and multiple actions such as jumping and sprinting.(1) These muscles include: Bicep Femoris, Semitendinosus, and Semimembranosus. Starting from the posterior pelvis and extending along the femur, almost all of the muscles of this complex cross both the Tibiofemoral and Femoroacetabular joints.(1)

Complex of Hamstring muscle obtain its blood supply from the Perforating branches of the deep femoral artery which is also called as Profunda Femoris artery. (1) The deep veins follow the same name as per the major arteries. Femoral vein is designated for the venous drainage of thigh region. In addition it also receives some degree of drainage from Profunda femoris.(1) Group of Hamstring muscle receives its innervation from the nerves of Lumbar and sacral plexus. Group of these plexus give origin to sciatic nerve (L4-S3) which further bifurcate into common peroneal nerve (fibular) and tibial nerve at tibiofemoral joint level. (1)

A very dominant role is being played by Hamstring muscle in hip extension and knee flexion. If concerning the gait cycle, this muscle group initiates the beginning in final 25% of the swing phase causing extension force at the hip and resisting knee extension. The hamstring muscle complex is also considered as a dynamic stabilizer of the knee joint. If talking in relevance with the Anterior cruciate ligament (ACL), the hamstrings resist anterior displacement of the tibia during the heel strike phase during the gait cycle.(1)

There are multiple conditions that can compromise the flexibility of hamstring muscle and resulted in the functional impairment. Hamstring Tendinopathy is one of the chronic and degenerative condition associated with the continuing morbidity and functional limitations. This condition is growing rapidly but diagnosis is slow and poor as patients present with apathetic symptoms, most commonly without having injuries and aggregating factors. For treating this condition different management protocols with specific follow up times are being used in clinical trials.(2)

Musculoskeletal pain, dysfunctions and spasms are the main problems associated with Hamstring Muscle group, it is also considered to be the cause of long-term pain affecting so many young individuals of worldwide. Without appropriate management, chronic pain affects multiple aspects of participant's health, not only the physical but also psychological and wellbeing of the individuals and it also creates a tremendous economic and workplace burden.(3)

Inability to achieve more than 160 degrees of knee extension when the hip is flexed to 90 degrees is considered as hamstring tightness. (4). Flexibility is the most important element of biomechanical function of human beings. When the muscle has lost or the capacity to deform is decreased, this is known as Muscle tightness. Hamstring tightness would lead to cause the chances of having recurrent injuries. In athletic population, it will decrease the performance too, which will be cause of decreased coordination and post exercise soreness.(5)

The main leading case of Hamstring tightness is extended or prolonged sitting at offices, schools and educational institutes, physical inactivity, genetically induced factors and any kind of Hamstring injury.(6) Habitual and Modern sedentary life style is considered one of the main reasons for postural abnormality which leads to tightness of not only the hamstring muscle but others too. The flexibility of Hamstring is reduced due to long sitting hours in work places and educational institutes.(6) There is a remarkable association of hamstring tightness with the prolonged sitting most commonly in the dominant limb.(4)

Prevalence of hamstring tightness among young adults is very high. According to a study its prevalence in different professions like Sewing machine operators which incorporates long sitting hours, was about 83.4% and it was mostly seen in males than females (6).

According to a survey conducted in Lahore the prevalence of hamstring tightness was found to be 40% among university students. Few Studies showed that hamstring tightness has been mostly targeting the female population as compared to the male ones. While multiple studies reported that athletes have a higher incidence of hamstring tightness. The Hamstring tightness is more commonly known to happen after pubertal growth spurt(14 to 19 years of age) associated with natural development of pelvic tilt and Lumbar Lordosis. Therefore it is important to be aware regarding the hamstring tightness to prevent the risk of multiple recurrent injuries. Hamstring muscle tightness mostly seen in people having sedentary lifestyles, athletes and college or university students.

Radiological means such as Ultrasonography (US) and Magnetic Resonance Imaging (MRI) have been used to diagnose one or more aspects associated with hamstring injury which are as follows; location of injury, length, cross-sectional area, edema, hemorrhage and volume of the wound if present. It is useful to predict the possibility of return-to-play which is considered in athlete population. Although the minor injuries of Hamstring muscle can be diagnosed clinically with the help of various tests, as these might not be seen on ultrasound or MRI in most of the cases.(7)

Clinically various tests commonly incorporated in the clinical setups to assess hamstring flexibility; Passive knee extension test, Active knee extension test, Sit and reach test(SRT), Back saver(SRT) and Chair sit and reach

(SRT). According to some studies it is preferable to determine the flexibility of hamstring muscle by Active knee extension test which is considered quite safe. (6).

Magnetic resonance imaging is highly recommended for accessing both the degree of hamstring injury and whether there is need of surgical intervention or not.

There are many methods to treat muscle tightness, such as resting, use of synthetic products, natural products, and nutritional supplements. Conservative management is indicated for acute injuries such as hamstring strains, partial hamstring tears, and tendon avulsions. Surgeries are indicated in case of complete proximal hamstring injuries, both acute and chronic which results in better results as compared to non-operative management. Acute proximal hamstring tendons tears can be repaired with the better functional results than repair of chronic tears. (8)

Strengthening and stretching protocols of the hamstring which incorporates eccentric training seems to be very effective in physical therapy management after injury and may lower the chance of re-injury.(8)

An alternative for relieving muscle fatigue is through dry needling. Dry Needling is a known concept of treatment for myofascial trigger points (TrPs), but it is not commonplace in the current physical therapy work field. It is considered a relatively new type of invasive intervention that can be utilized by physical therapists (9).

There is large number of stretching techniques, physical agents and medications that has been widely used as interventions for hamstring muscle tightness. Muscle Energy techniques such as hold-relax, other manual techniques such as stretching, and soft tissue mobilization have been commonly used in the clinical practice to improve hamstring tightness, but the outcomes would have been inconsistent.(10)

Concerning the Electrotherapy, Diathermy therapy is one of the common modality, it relaxes the muscles by transmitting heat deep into the muscular tissue. High-frequency diathermy (HFD) therapy produces heat through molecular vibrations in deep tissues. Blood circulation and tissue flexibility has been known to increase by the application of High frequency diathermy which results in muscle relaxation. It also raises the local tissue temperature by 40°C–45°C, thus the threshold of pain increases to some extent, as a result reduced pain and enabling maximum stretch without damage are the resulted outcomes.(10)

Treatment options that are worldwide used most frequently in order to improve the hamstring flexibility and for the reduction of hamstring tightness are muscle energy techniques (MET) which are believed to be effective in lengthening a shortened muscle. MET, particularly post isometric relaxation (PIR) and static stretching has shown to be effective in improving hamstring flexibility.(11)

Post Isometric Relaxation is a manual technique which causes the contraction of particular muscles in an effective way, as a result the range of motion and flexibility of the muscles would increase. The relaxation is produced as a result of isometric contraction of the muscles with Muscle Energy techniques (inhibition and facilitation techniques). (12)

Post isometric relaxation-muscle energy technique (PIR-MET) has been contributed a great role in increasing the muscle strength in degenerative conditions, knee osteoarthritis and other degenerative disease of synovial joints. Physiologically, there is a remarkable decrease in the muscle strength in case of knee osteoarthritis in the following muscles; (13) Quadratus femoris, Soleus, Hamstrings, Gastrocnemius: the technique is performed by placing the muscle in a stretched position (lengthening it), to the point where the movement is resisted slightly as a little barrier.

As a result the muscle stretches by immediate relaxation and get into a new relieved position for 30 seconds. The technique was repeated 4 times for every muscle. (14) Both interventions were found to be effective for flexibility, concentric strength, and functional performance.

According to a previous study the score of Active knee extension after post isometric relaxation technique gave insignificant improvement within two weeks with the isometric contraction of about 5 seconds at 75% of the maximal effort of hamstring muscle followed by 3 seconds of relaxation for a total three repetitions. (15)

Static Stretching is another type of manual technique in which specific movement is performed for a particular muscle with either the assistance from a therapist or self-assisted to produce a relaxation effect in muscles, fascia and connective tissues. It mainly emphasizes on maintaining the end-range position of the joint with also a slight stretch in the trained and healthy muscles.

Static stretching is well known to increase the flexibility of tight muscles, prevent injuries, reduce the risk of re-injuries and increase the range of motion (ROM) which is often measured as an indicator of flexibility. Past studies showed that ROM was affected by both muscle-tendon unit stiffness and stretching tolerance. (16).Muscle-tendon stiffness can be effectively reduced by the application of Static stretching.(16)Reduction in the muscle-tendon stiffness further depends upon the intensity and duration of stretching. The intensity of static stretching is determined by the range of motion or point of discomfort (POD) of each participant, 100% intensity of static stretching is considered as normal intensity for pain of discomfort(POD), which is performed at the maximum joint angle without pain.(16)

Muscle stretching exercises can also be used in the preparatory phase of physical activity in terms of Rehabilitation, occupation, recreation, or competitive sports.(17)

Static stretching is considered one of the most commonly and widely used intervention of hamstring tightness, but the use of other treatment options like Proprioceptive neuromuscular facilitation (PNF) and instrument-assisted soft tissue mobilization (IASTM) is also of great value in clinical practices.(18) According to some studies Static stretching combined with post isometric relaxation proves to be more worthwhile than static stretching alone for the improvement in the flexibility of the hamstring muscles. Clinically important differences were found for an increased range of motion for both tests such as passive straight leg raise and active knee extension.

2. LITERATURE REVIEW

Won Jin Chang et al carried out a systemic review and meta-evaluation to observe the synergistic effect of two techniques that is, static stretching and Post isometric relaxation in the improvement of hamstring flexibility. Twelve articles were reviewed and hence it concluded that to increase flexibility in individuals with hamstring strain, static stretching and post isometric relaxation both technique proves to be effective (11).

Sathe et al in the year 2020 conducted the comparative experimental study on individuals having hamstring tightness to compare the effect of Reciprocal inhibition and Post isometric relaxation technique. The participants were assigned into two groups and to evaluate both techniques active knee extension as an outcome measure was executed before and after the treatment. It was concluded that reciprocal inhibition technique show significant improvement in reducing hamstring tightness than post isometric relaxation (19).

Sapna Chaudhary et al conducted quasi experimental study to compare and observe the efficacy of post isometric relaxation and static stretching on the flexibility of iliopsoas muscle. The Thomas and hamstring extension test was performed pre and post treatment. The study results concluded that the post isometric relaxation was more effective than static stretching to increase flexibility in iliopsoas muscle (20).

A randomized controlled study conducted by Jawad Naweed et al in students of Islamabad federal college to compare the efficacy of post isometric relaxation versus active isolated stretch on the flexibility of hamstring muscle. The post isometric relaxation and active isolated stretch were performed and to assess the tightness active knee extension test was performed prior to the treatment. The results showed that both of these techniques were correspondingly efficient in producing direct, short and long term effects on the hamstring muscle (12).

A randomized controlled trial research was conducted in 2018 by Kanza Masood et al to compare the efficiency of dynamic stretching and static stretching in hamstring tightness. The group of participants with hamstring tightness received dynamic stretching and the other received static stretching. This study concluded that the dynamic stretching was more efficient in enhancing flexibility of the posterior thigh muscle than static stretching (21).

Wan Chik et al conducted a study on 10 futsal players to observe and evaluate the effects of eccentric strength training and static stretching on the flexibility of hamstring muscle. They were assigned a 4 week program consisting 3 session each, one performed eccentric training by using Nordic hamstring exercise and the other performed static stretching. Both techniques were found efficient to increase flexibility of tightened hamstring (22).

Mariana Oliveira Borges et al conducted systemic review and meta-analysis in 2018 to compare the efficiency of proprioceptive neuromuscular facilitation and static stretching on hamstring. The idea of this study was to compare these techniques on both sedentary and active young individuals. The results showed that both the techniques were effective for hamstring muscle (23).

In 2021, a research study was carried out by P Mohamadi et al. to evaluate the effects of two techniques i.e. TECAR (capacitive and resistive energy transfer) therapy and static stretching for the flexibility of hamstring in athletes. This randomized controlled trial included athletes assigned to groups, one received TECAR therapy and the other received static stretching. This study concluded that the TECAR therapy enhances hamstring flexibility as compared to static stretching (24).

A single blind controlled trial was conducted in 2021 by Nasir et al on the participants with backache to observe the effectiveness of static stretching versus stretching with traction on flexibility of hamstring. This study assigned participants into groups performing these techniques. The straight leg raise test was used pre and post treatment to observe the ranges. The results showed that stretching with traction decreases hamstring tightness and pain that is, measured by visual analog scale (25).

A cross-sectional study carried out by Ghulam Fatima et al in 2017 to observe the effects of sedentary lifestyle or prolonged sitting on tightness or reduced flexibility seen in major muscles such as hamstring. The straight leg raise (SLR) and active knee extension tests were used to evaluate the tightness of the hamstring. It was concluded that hamstring tightness was majorly observed in the students with prolonged sitting or sedentary lifestyle so it can be a contributing element (26).

3. RATIONALE

There was a limited literature available in the past in which these two techniques were compared. While the previous studies compared the effects of these two techniques with some other manual techniques or mentioned separately. However, there was a lack of consensus on whether Post Isometric Relaxation or Static Stretching is more beneficial for the hamstring tightness and the results were controversial.

The study investigated the outcomes of Post Isometric relaxation and static stretching in improving hamstring flexibility and analyzing whether these two protocols proves to be beneficial in order to improve the flexibility of hamstring tightness. As most of the individuals having hamstring tightness had not complaint of any pain and discomfort so this study aimed to mainly target the asymptomatic university students whereas, previous targets were mainly focused on symptomatic population.

4. OBJECTIVES

- Compare the Effects on Active Knee Extension (AKE): To assess and compare the impact of Post Isometric Relaxation (PIR) and Static Stretching (SS) on Active Knee Extension in individuals with hamstring tightness, determining which technique yields superior results.

- Evaluate the Effects on Straight Leg Raise (SLR): To analyze and compare the outcomes of PIR and SS on Straight Leg Raise, measuring the improvement in hamstring flexibility and determining whether one technique demonstrates greater efficacy than the other.
- Assess the Impact on Sit and Reach Test (SRT): To examine and compare the effects of PIR and SS on the Sit and Reach Test, a commonly used measure of hamstring flexibility, aiming to identify any significant differences in outcomes between the two techniques.
- Analyze Within-Group and Between-Group Differences: To conduct a comprehensive analysis of within-group and between-group differences in hamstring flexibility, using statistical measures to determine the significance of improvements observed within each group and the comparative effectiveness of PIR versus SS.
- Explore the Overall Comparable Effectiveness: To draw an overarching conclusion on the comparable effectiveness of Post Isometric Relaxation and Static Stretching in improving hamstring flexibility among asymptomatic healthy individuals, providing insights into the optimal technique for managing hamstring tightness in this population

5. METHODOLOGY

5.1. Study Design

This was a Randomized control study in which the participants were assigned into 2 groups by using toss a coin method. Group A was applied with post isometric relaxation and static stretching to Group B.

5.2. Study Duration

The study duration was 6 months from December 2021 to June 2022.

5.3. Study Setting

The study was conducted on students of Rehabilitation department of Shifa Tameer-e-Millat University Islamabad, Pakistan.

5.4. Sample Size

The sample size was calculated using open EpiTool (27). The variable used from the parent study was Straight Leg Raise (SLR). The value of group 1 Mean \pm SD used was 56.7 \pm 11 and group 2 was 59.4 \pm 11.6 (Power 80%, CI 95%). The calculated sample size was 22 (11 participants in each group) but to increase generalizability the sample size was extrapolated to 50 participants (25 in each group).

5.5. Sampling technique

Non-probability convenient sampling technique was used.

a. Sample Selection

The participants were selected on the basis of inclusion and exclusion criteria.

i. Inclusion Criteria

- Either gender
- Young adults of age 18 to 25 years.

- Individuals with asymptomatic hamstring tightness with range 70 to 90 degrees measured after performing straight leg raise test.

Exclusion Criteria

- History of any trauma, fractures, meniscal injuries and systemic illness such as cardiovascular diseases, respiratory disorders etc.
- Any lower limb musculoskeletal deformities.

b. Data collection instruments

Demographic questionnaire comprised of participant's name, age, gender, weight, height, any diagnosed disease and previous history of any musculoskeletal discomfort.

The Active Knee Extension Test

This test was used for the assessment of the knee extension. According to research evidence, the AKET displays strong reliability and validity as this test standardizes the measuring process such that varied measurements correctly reflect changes in patient's status. The reliability coefficient for test and retest measures of active knee extension was 0.99 (28). The normal value is considered to be within 20 degrees of full extension.

Lower Extremity Functional Scale

For lower extremity function we used this scale. It was a five point-scale questionnaire based on 20 different questions about their performance or difficulties in daily activities. The score ranges from 0 that is minimum and maximum 80, lower the score, the greater is the disability. This scale was proved to be highly reliable and valid in lower limb injuries and disorders (29).

Straight Leg Raise Test

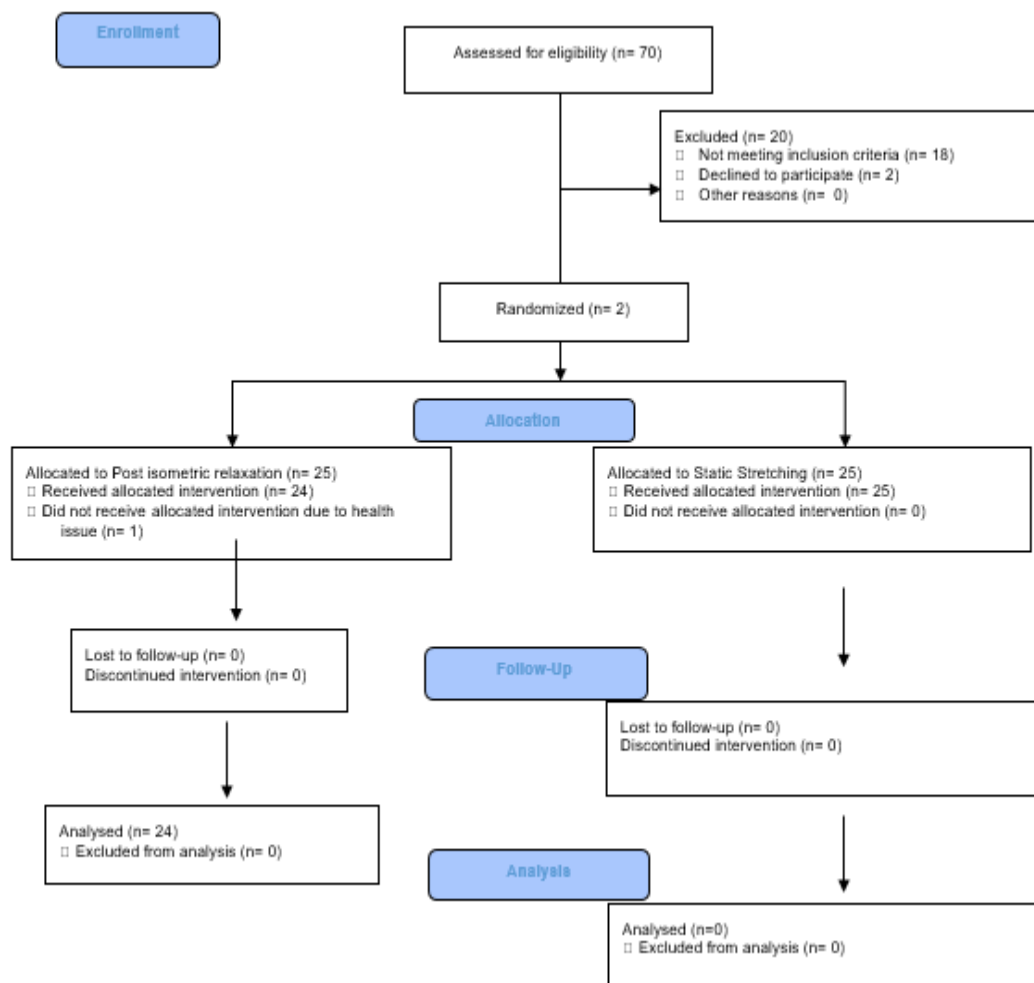
The SLR test was used to assess the flexibility of lower limb muscles. The normal range for the flexibility of hamstring was 90 degrees and above. Researches have proved the SLR to be the effective tool of measure for lower limb tightness (30). SLR test was a valid and reliable measure to detect hamstring tightness and low back dysfunction.

Finger to Floor Distance Test

The FFD was a test to evaluate hamstring flexibility during active motion. The participant was asked to touch his or her feet by keeping their legs straight and bend forward, then measurement was taken from middle finger to the great toe. The normal distance between tip of the finger and floor was 0 to 48cm for men and 0 to 50 cm for women. The intra- reliability of the finger to floor distance test was 0.99 (31).

Standard Sit and Reach Test

This test was used as a tool to measure low back and lower limb muscles flexibility. This test was performed with the help of sit and reach box placed on the couch and then patient was asked to place both legs on both sides of the box and was commanded to touch the possible range marked on the box (32). The normal range observed in male was 32-41 cm and female was 36-44cm. This test was construct valid and highly reliable to test the tightness



RESULTS

A total of 49 participants were enrolled in the study out of which 29 (59.2%) were females and 20 (40.8%) were males. The mean age of participants in Post Isometric Relaxation group was 22.083±1.44 and 21.72±1.62 in Static Stretching group.

The within group analysis was done using Wilcoxon signed rank test to compare effect of both techniques at pre and post levels. Pre and post median (IQ) and mean rank was improved across all the variables (Table 1 and 2). The results were also statistically significant as P value was less than 0.05 which showed that both the techniques were equally effective in improving hamstring flexibility at the post treatment level.

Whereas between groups analysis was done using Mann-Whitney U test. Clinically significant difference was observed at post treatment level across variables such as right active knee extension and lower extremity functional scale (Table 3). These variables showed more improvement in PIR as median (IQ) and mean rank of right active knee extension was 64 (21.5) and lower extremity functional scale was 78 (3.75) (Table 3) yet no significant improvement was seen at the post treatment level as P value was greater than 0.05 which showed that both the techniques have same effect on hamstring tightness.

Table 1: Between group analysis across variables active knee extension (right and left), straight leg raise (right and left), sit and reach test, finger to floor distance test and lower extremity functional scale.

Variables	Groups		Median(IQ)	Mean Rank	P- Value
Right Active Knee Extension	PIR	PRE	57.00(25)	27.4	0.249

(AKE)	SS	POST	64.00(21.5)	27.98	0.152
		PRE	52(21)	22.7	
		POST	58(23)	22.14	
Left Active Knee Extension (AKE)	PIR	PRE	59(25.75)	26.85	0.372
		POST	62.5(21.25)	27.13	
	SS	PRE	55(20.5)	23.22	0.306
		POST	60(25)	22.96	
Right Straight Leg Raise (SLR)	PIR	PRE	72(5)	24.4	0.762
		POST	75(5)	27.35	
	SS	PRE	73(5)	25.58	0.251
		POST	75(7)	22.74	
Left Straight Leg Raise (SLR)	PIR	PRE	73(5)	26.42	0.474
		POST	76(5)	27.65	
	SS	PRE	72(5)	23.64	0.196
		POST	75(4)	22.46	
Sit and Reach (SSR)	PIR	PRE	28(6.5)	27.27	0.274
		POST	32(5)	28.63	
	SS	PRE	26(7)	22.82	0.8
		POST	30(5)	21.52	
Finger to Floor distance (FTF)	PIR	PRE	28(6.25)	20.79	0.43
		POST	25.5(6.75)	20.92	
	SS	PRE	31(10.5)	29.04	0.49
		POST	27(9)	28.92	
Lower Extremity Functional Scale (LEFs)	PIR	PRE	67(10.5)	22.25	0.186
		POST	78(3.75)	28.23	
	SS	PRE	71(7.5)	27.64	0.119
		POST	76(5)	21.9	

Table 2: Static Stretching Within group analysis across variables active knee extension (right and left), straight leg raise (right and left), sit and reach test, finger to floor distance test and lower extremity functional scale.

Variables		Median(IQ)	Mean Rank	P-Value
Right Active Knee Extension (AKE)	PRE	52(21)	11	0.000
	POST	58(23)	0	
Left Active Knee Extension (AKE)	PRE	55(20.5)	10.5	0.000
	POST	60(25)	1	
Right Straight Leg Raise (SLR)	PRE	73(5)	10	0.000
	POST	75(5)	0	
Left Straight Leg Raise (SLR)	PRE	72(5)	11	0.000
	POST	75(4)	0	
Sit and Reach (SSR)	PRE	26(7)	13	0.000
	POST	30(5)	0	
Finger to floor distance (FTF)	PRE	31(10.5)	12	0.000
	POST	27(9)	0	
Lower Extremity Functional Scale (LEFs)	PRE	71(7.5)	12.5	0.000
	POST	76(5)	0	

Table 3: Post Isometric Relaxation Within group analysis across variables active knee extension (right and left), straight leg raise (right and left), sit and reach test, finger to floor distance test and lower extremity functional scale.

Variables		Median (IQ)	Mean Rank	P-Value
Right Active Knee Extension (AKE)	PRE	57(25)	11.43	0.000
	POST	64(21.5)	2.5	
Left Active Knee Extension (AKE)	PRE	59(25.75)	9.97	0.001
	POST	62.5(21.25)	10.5	
Right Straight Leg Raise (SLR)	PRE	72(5)	11.5	0.000
	POST	75(5)	0	
Left Straight Leg Raise (SLR)	PRE	73(5)	10	0.000
	POST	76(5)	0	
Sit and Reach (SSR)	PRE	28(6.5)	12	0.000
	POST	32(5)	0	

Finger to Floor Distance (FTF)	PRE	28(6.25)	14.5	0.000
	POST	25.5(6.75)	11.36	
Lower Extremity Functional Scale (LEFs)	PRE	67(10.5)	11.5	0.000
	POST	78(3.75)	0	

DISCUSSION

Hamstrings tightness is a common problem among young adults with sedentary lifestyle. There were multiple studies available which compared these two techniques on different muscle groups and on different regions but there was limited literature available which compared these techniques to observe their effects on hamstring muscle tightness.

The study results showed significant improvement for within group analysis while between groups analysis showed no significant difference in improving flexibility which means that both the groups have same effect. Similar results were reported in a research study which showed that while comparing the two groups, no treatment technique was found superior than the other (33). Many studies were conducted on hamstring muscle to evaluate the efficacy of these treatment techniques. One of the randomized controlled study conducted by Surojit Biswas showed beneficial effects of both techniques among student population with hamstring shortness (34). Another study revealed same results that these treatment techniques increase hamstring flexibility but this also showed that static stretching when combined with post isometric relaxation displayed more improvement in flexibility of hamstring than these techniques performed alone (11). Both the treatment protocols were efficient in producing immediate, long term and short term effects on the tightness of hamstring muscle (12).

Static stretching and post isometric relaxation both techniques showed efficient results and outcomes in any muscle group. Similarly, in a randomized controlled study which compared the effect of passive static stretching and PIR in chronic neck pain and the results varied from the current study as PIR showed significant improvement in neck pain and mobility than passive static stretching. (35) The difference in results might be due to changed outcome measures, different treatment protocol and muscle group involved as it mainly targets trapezius, levator scapulae and sternocleidomastoid muscles. In another Quasi experimental study conducted to compare the effects of post isometric relaxation and static stretching on hamstring tightness and their results varied from our study as it showed more improvement in PIR than static stretching. The difference in results might be due to different outcome measure and involvement of different muscle group as it targets Iliopsoas muscle (36). Many studies were carried out using one of these techniques (PIR, SS) in comparison with any other technique to observe the superiority of that treatment technique. One study observed more improvement while including Post isometric relaxation technique with the conventional treatment program of physical therapy in minimizing pain, disability and enhancing range of motion for cervical region than using only traditional treatment program. A study by Agrawal Sonal S investigated the effects of Muscle energy technique including two treatment techniques such as reciprocal inhibition and post isometric relaxation and showed significant improvements for Post isometric Relaxation (37).

Some studies also observe the effects of these treatment techniques i.e. PIR and SS alone on specific muscle group to observe its effects. Another research conducted by Kosuke Takeuchi and Masatoshi Nakamura on the Static Stretching for evaluating the strength and flexibility of hamstring muscle and range of motion was increased at post measurement (38). Another research conducted by Sutantar Singh and Kavita Kaushal to find the effects post isometric relaxation. Active knee extension range was measure by the Active knee extension test prior to and after the treatment session. Both the groups showed a significant increase in active knee extension range of motion. However, the outcomes were more significant for maximum voluntary isometric contraction (15).

A randomized controlled study carried out by Kanza Masood et al. to compare the efficacy of dynamic oscillatory stretch technique and static stretching on reduced hamstring flexibility in healthy beings with asymptomatic hamstring tightness. Group 1 showed significantly more improvement for dynamic oscillatory than the static stretching in hamstring flexibility (39).

LIMITATIONS

- Initially Pendular goniometer was planned used to determine the ranges during straight leg raise and active knee extension, but it was not delivered so universal goniometer was used.
- Time period for this study was about 6 months but due to unavailability of students in the campus we suffered shortage of time.

RECOMMENDATIONS

- In future studies can be carried out to evaluate the long term effects of post isometric relaxation and static stretching technique.
- Other studies can be conducted using the same technique on the symptomatic individuals having hamstring tightness.
- Researchers can compare these two techniques with other techniques to determine which technique is superior and produce better results on hamstring tightness.

CONCLUSION

The current study concluded that post isometric relaxation and static stretching were equally effective in improving hamstring flexibility in asymptomatic healthy individuals. The findings of this study suggest that both post isometric relaxation (PIR) and static stretching (SS) techniques exhibit significant improvements in hamstring muscle tightness among young adults with a sedentary lifestyle. While within-group analyses demonstrated notable enhancements in flexibility for both techniques, between-group analyses revealed no significant differences, indicating that both PIR and SS have comparable effects on improving hamstring flexibility. These results align with previous research, emphasizing the efficiency of both techniques across various muscle groups. It is important to acknowledge the limitations of the study, such as the use of a universal goniometer instead of the initially planned pendular goniometer and the time constraints due to unavailability of students on campus. Future research could explore the long-term effects of these techniques, extend the study to symptomatic individuals with hamstring tightness, and compare PIR and SS with other techniques to determine superiority and efficacy in addressing hamstring tightness

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