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Immediate effects of muscle energy technique (post isometric relaxation) and static stretching in improving lumbar range of motion and iliopsoas flexibility on iliopsoas muscle tightness

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Abstract

Iliopsoas is a compound muscle which consists of the psoas major and iliacus. Shortening of the iliopsoas muscle was found to be the primary cause of lumbar hyper lordosis and excessive anterior pelvic tilt. iliopsoas is a muscle of lower extremity prone to tightness with prevalence of 83% in young and middle-aged adults leading to lower back pain.

Aim of the study: The aim of the study was to compare the effect of static stretching and muscle energy technique to improve lumbar range of motion and iliopsoas flexibility.

Study design: A Research with experimental design was performed in 2 groups that were selected from collage in Navsari.

Methodology: Immediate effect comparative study to evaluate the effectiveness of MET versus Static Stretching techniques for iliopsoas tightness. One group was given MET and other group was given Static Stretching. Modified Thomas test and schobers test was taken for lumbar flexibility and lumbar range of motion in iliopsoas tightness subject.

Result: The MET (Group A) was associated with a statistically significant change in Lumbar flexibility than Static Stretching (Group B). There was no statistically significant change observed Lumbar range of motion in both the groups.

Conclusion: The present study concluded that both MET and Static Stretching technique are shown to have an effect on improving lumbar range of motion and lumbar flexibility. The MET technique was found clinically more effective in improving lumbar range of motion and lumbar flexibility in iliopsoas tightness muscle. However, there is no significant difference found in lumbar flexibility between both the groups MET and Static stretching groups.

Keywords: Iliopsoas tightness, met, static stretching

Introduction

Iliopsoas is a compound muscle that consists of the psoas major and iliacus. The psoas major is placed lateral to the vertebral column. It begins at the thoracic vertebrae 12 and the vertebral body of the lateral surface of the lumbar vertebrae 5 and extends to the transverse process of the lumbar vertebrae 1 to 5, and finally attaches to the femur lesser trochanter and the linea aspera medial ^[1]. The iliacus has several points of origin; it starts with the iliac crest, anterior inferior iliac spine, iliolumbar ligament, and anterior sacroiliac ligament, and eventually attaches to the femur lesser trochanter and Linea Aspera medial ^[1].

In modern times, most the day-to-day activities like work or study involve constant sitting or standing with limited bodily movements. Such conditions in the long-term can have a negative effect on the iliopsoas muscle and often lead to the shortening of adaptations ^[2]. Since the iliopsoas is constantly active while sitting or standing, it plays an important role in stabilizing the pelvis and lumbar region along with the erector spinae and quadratus lumborum ^[3].

Hence shortening or straining of the iliopsoas can cause excessive pelvic anterior tilt or increased spine extension during hip joint motion, thereby acting as a risk factor for low back pain ^[4]. Shortening of the iliopsoas muscle was found to be the primary cause of lumbar hyperlordosis and excessive anterior pelvic tilt: The iliopsoas is the postural muscle and has been observed to have a lot of tendencies to shorten ^[5].

A short iliopsoas pulls the spine into hyperlordosis and an anterior tilt pelvis which puts stress on all the spinal muscles leading to low back pain. Shortened iliopsoas muscle acts limit the available range of hip extension [6]. Shortening of this muscle group also limits lateral flexion on the contralateral side and ipsilateral rotation of the lumbar spine [7].

Flexibility can be improved through a wide variety of techniques like stretching, PNF technique. The use of Muscle energy technique, specifically the post isometric Relaxation (PIR), static stretching is found to be an effective technique for improving lumbar range of motion and lumbar flexibility [8].

Prevalence of Iliopsoas Tightness: A study conducted by Pradip B et al on the Prevalence of tightness in hip muscles in middle-aged Indian men engaging in prolonged desk jobs concluded that 83.8% showed tight in a majority of desk job professionals, in their middle age with a longer work history could develop tightness in these muscles making them prone to low back pain or other symptoms associated with back or hip in some point of time in their life.

MET (Post Isometric Relaxation)

MET (Post Isometric Relaxation) is one of the used widely and it consists of pacing joint in maximum available ROM and performing a submaximal isometric contraction against resistance for 5-10 seconds and followed by complete relaxation taking the joint to new range of motion. The submaximal isometric contraction causes the relaxation of the muscle by activation of the Golgi tendon organ by autogenic inhibition.

Static Stretching

Static Stretching is a commonly used stretching method in which soft tissues are elongated just past the point of tissue resistance and held in lengthened position with a sustained stretch force over a period of time usually ranging from 5 seconds to 5 minutes. Although in the review of the literature of studies done on calf muscle stretching show 30 seconds of hold per repetition as the median duration of the hold (30).

Studies have shown that both the MET technique and Static Stretching are used effectively in the treatment of tight iliopsoas muscle. However, there are no studies found in the literature which compare the effects of these two techniques. The present study is a research question whether there is any difference between technique MET versus Static Stretching on improving of lumbar flexibility and lumbar range of motion, with tight iliopsoas muscle. Hence the purpose of the study is to compare the effectiveness of the Muscle energy technique versus Static Stretching on improving lumbar flexibility and lumbar range of motion.

Methodology: Study Design: The research design used for present study was Experimental pre-test – post-test study design.

Study Population: subjects with Iliopsoas Muscle Tightness

- **Sampling Technique:** Convenient Sampling, Sample size is calculated on G* power software on the basis of mean of lumbar range of motion of the previously reported study from a similar population of patients

with iliopsoas tightness effect size 0.9025 and significance level of 0.05 and 0.80 power was selected. These criteria led to an estimated sample size of 50 participants in each group and to take into account a probable no drop out, the sample size is enhanced to 50 in each group so total 100 patients were included in this study

Study Duration: 6 month.

Source Of Data Collection: S.S. Agrawal institute of Physiotherapy, Navsari.

Inclusion Criteria:

- Age (18-25) years
- Iliopsoas Tightness
- Non-Athletes
- Willingness to participate

Exclusion Criteria

History of Trauma of lumbar spine and pelvic

- Inflammatory condition that affect motion
- low back pain
- Any cardiac problem
- Presence of tumour's that restrict hip ROM
- Spinal deformity
- Any recent injury and surgery

Tools and Materials: Pen

- Informed consent form, Data recording sheet, Plinth, Goniometer, Measure tap

Procedure of The Study: The purpose of this study was explained and a written informed consent was obtained from all the subjects. The study procedure was conducted through assessing patients, initial recording, treatment and final recording. Hundred participants volunteered to be a part of this study based on the inclusion and exclusion criteria. Subjects were allocated into two groups, group A (MET group) and group B (Static Stretching group) by using quasi-randomization procedure as follows. First subject was allocated to Group A, second visiting subject to Group B once they fulfilled the inclusion and exclusion criteria. The same sequence of procedure was followed throughout for consecutive subjects.

Descriptions of groups were as follows:

Group A MET (post isometric stretching): patients were administered MET technique by researcher.

Group B (static Stretching): patients were administrated Static stretching technique by researcher.

All the patients completed demographic details and physical examination performed by the researcher. On the day of the study all subjects underwent a baseline assessment prior to any intervention using like lumbar ROM (Using goniometer, schobers test, inch tape) and MLT (modified Thomas test). All the measurements were taken by the researcher of the study

Sequence of Stretching exercise Group A (static stretching group)

All the 50 patients had received passive stretching by researcher.

Procedure

Group A – Post Isometric Relaxation

The Hold-Relax stretching technique was used in the same position as the modified Thomas test. The shortened iliopsoas in affected leg was treated by HR. The target hip was moved toward the floor until the participant felt a mild stretch sensation. Then participant was asked to perform a sub maximum voluntary isometric contraction (MVIC) (approximately 25% MVIC) ^[10] of iliopsoas muscles for 10 seconds. Then completely relax for 10 seconds. The participant's leg was slowly moved towards new range until a mild stretch sensation was felt and held at this position for 30 seconds. This HR stretching was repeated 4 times followed by a 30 second rest. All the subjects were immediately measured after invention for post-test by the same examiner.

Patient's position supine lying at the edge of the table, non-tested leg in flexion at both hip and knee and experimental thigh and leg hang on the edge of table. Extend the knee of the opposite thigh up to the barrier. After that told the patient to flex the hip against minimal resistance (isometric) and to breath in for 10 seconds. Told the patient "relax" and exhale slowly. Wait for 5 seconds as long as relaxation takes place. Three times repeat this procedure ^[12].



Fig 1: MET for Iliopsoas muscle

Group B – Static Stretching Patient position

Patient position close to the edge of the treatment table so the hip being stretched can be extended beyond the neutral position. The opposite hip and knee were flexed towards the patient's chest to stabilize the pelvis during the stretching. Hand placement and procedure: Stabilize the opposite leg against the patient's chest with one hand, or if possible patient assist by grasping around the thigh and holding it to prevent tilt of the pelvis during the stretching. Move the hip to be stretched into extension or hyperextension by placing downward pressure on the anterior aspect of distal thigh with your other hand. Allow the knee into extension so the two joint Rectus Femoris does not restrict the range. The stretched was maintained by 30 seconds and performs three time ^[13].



Fig 2: MET for Iliopsoas muscle

Outcome measures

Lumbar range of motion

Modified Thomas Test: Patient held in supine position with buttocks as close to the end of the table as possible, the non-tested leg in flexion at both hip and knee hold by patient themselves. Full flexion of hip helps to maintain the pelvis in full rotation with the lumbar spine flat. If the tested thigh lies in horizontal positioning which it is parallel to the floor that indicates Iliopsoas is not short. If the thigh rises above the horizontal positioning that indicates Iliopsoas is short. Goniometer alignment for measuring the length of the hip flexors.

1. Center fulcrum of the goniometer over the lateral aspect of the hip joint, using the greater trochanter of the femur for resistance.
2. Align proximal arm with the lateral midline of the pelvis.
3. Align distal arm with the lateral midline of the femur, using the lateral epicondyle for reference ^[18].
4. Interpretation: Restricted $>0^\circ$ above the horizontal
Normal $> 15^\circ$ above the horizontal ^[19]

Measurement of Lumbar Flexion: (Schober's test)

1. The volunteers were instructed to remove their shoes and disrobe, exposing their back from gluteal fold to mid-thoracic spine with left and right PSIS fully exposed ^[14].
2. The volunteers were asked to stand erect, with their eyes directed horizontally, arms at their sides, and feet placed on a paper footprint that was secured to floor (the heels of the footprint was about 15cm apart) ^[17].
3. This position helped the volunteers to stabilize the pelvis, aided them in maintaining their balance and helped us to improve the consistency of measurements ^[14].
4. Then, the therapist demonstrated the proper procedure of forward bending with the arm hanging in front and keeping knees straight. After showing the proper procedure, the therapist confirm th at the volunteers were doing it correctly. Then the therapist kneeled behind the standing volunteers and identified both the PSIS with her thumb.
5. Inferior margins of the volunteers PSIS were marked with body marker and a ruler was used to locate and mark a midline point on sacrum (inferior mark). Then the final mark (superior mark) was mark on the lumbar spine 15cm above the midline sacral mark (inferior mark) ^[16].
6. The therapist aligned the tape measure between two skin mark with zero at inferior mark and 15cm at superior skin mark. The measuring tape was kept firmly against the volunteer's skin while the volunteers were asked to bend forward with the instruction "bend forward as far as u can while keeping the knee straight".
7. The measuring tape was maintain against the volunteers back during the movement but was allowed to unwind to accommodate motion ^[15].

Measurement of Lumbar Rotation:

1. According to the AMA the normal range of motion value for lumbar rotation using the universal goniometer is 45 degrees.
2. Seat the individual in a chair without back. Centre fulcrum of the goniometer over the centre of the cranial aspect of the individual's head.

3. Align proximal arm parallel to an imaginary line between the two prominent tubercles of the iliac crest.
4. Align distal arm with an imaginary line between the two acromial processes.
5. Ask the individual to turn the body to one side as far as possible, keeping the trunk erect and feet flat on the floor. The end of the motion occurs when the examiner feels the pelvis start to rotate [18].

Normality of the data was checked. Since the outcome measures were measured within group pre-test and post-test values. Descriptive statistics including mean and standard deviation were analysed and Between-group differences at follow-up period were compared. Statistical significance was set at $p < 0.05$ for all statistical analyses and confidence interval was set at 95 %. All the data analysis was done in IBM SPSS version 20.0.

Measurement of Lumbar Side Flexion

The normal value of individuals averaged 21.6 centimetres.

1. Ask the individual to assume a standing position with back flat against the wall, feet shoulder width apart, and arms hanging freely at the sides of the body.
2. Direction the individual to bend to the side as far as possible while keeping back and shoulders against the wall and both feet flat on the ground with knees extended.
3. At the end of ROM, make a mark on the leg level with the tip of the middle finger, and use a tape measure or ruler to measure the distance between the mark on leg and the floor [18].

Results

The statistical analysis for the present study was done for Group-A & Group- B based on the readings taken after the treatment when the patients had approached the researcher for the treatment. For better understanding the readings that were taken for statistical analysis were given the terms pre and post for Group A and Group B.

Table 1: Demographic Data

Variable	Met Group	Static Stretching Group
Subjects	50	50
Age	20.26 ± 1.33	20.38 ± 1.12

Table 1 shows the demographic data of the both groups including number of patients and age.

Table 2: Normality of Data

Outcome	Shapiro-Wilk test		
	Statistic	Difference	Sig.
FP	0.949	100	0.001
RP	0.947	100	0.001
FSPRE	0.950	100	0.001
LTPRE	0.808	100	0.000

Table- 2: A Shows test of Normality of 100 subjects from the MET group and Static stretching Group which were included in present study. In this Shapiro-Wilk test are used and according to that data were not normally distributed so Non- parametric test were used for further analysis.

Table 3: Wilcoxon Signed Rank test for within group comparison of, ROM and MLT in Group A (n=50)

Variables	Level	Mean ± SD	Z Value	P Value
Flexion ROM	Pre	4.442 ± 0.939	-5.988	0.000
	Post	4.88 ± 0.89		
Rotation ROM	Pre	33.9 ± 6.57	-5.050	0.001
	Post	35.74 ± 6.42		
Side Flexion ROM	Pre	16.29 ± 3.55	-5.605	0.000
	Post	18.2 ± 2.99		
MLT ROM	Pre	-2.800 ± 2.6573	-6.110	0.000

Table 3 shows there is an significant difference between pre-post treatment

Table 4: Wilcoxon Signed Rank test for within group comparison of, ROM and MLT in Group B (n=50)

Variables	Level	Mean ± SD	Z Value	P Value
Flexion ROM	Pre	4.33 ± 0.90	-4.877	0.000
	Post	4.57 ± 0.91		
Rotation ROM	Pre	34.78 ± 5.89	-3.676	0.000-
	Post	34.78 ± 5.89		
Side Flexion ROM	Pre	16.560 ± 3.7616	-4.232	0.000
	Post	17.180 ± 3.4013		
MLT ROM	Pre	-2.420 ± 3.4112	-5.755	0.000
	Post	-390 ± 3.6102		

Table 4: shows there is an significant difference between pre-post treatment in Group B

Table 5: Mann-Whitney U test for between group comparison ROM, MLT in Group B.

Variables	Level	Mean ± SD	Z Value	P Value
Flexion Rom	POST A	4.88 ± 0.89	-1.98805	0.0466
	POST B	4.57 ± 0.91		
Rotation Rom	POST A	35.74 ± 6.42	0.43086	0.6672
	POST B	42.0 ± 47.66		
Side Flexion Rom	POST A	18.26 ± 2.99	1.36153	0.17384
	POST B	17.18 ± 3.40		
Post mlt	POST	2.830 ± 2.5865	-4.540	0.00
	POST	-390 ± 3.6102		

Table 5 shows there is a significant difference between post treatment in Group A and Table 5 Table shows there is a significant difference between post treatment in Group A and Group B.

Discussion

The purpose of the study was to compare the effect of muscle energy technique and static stretching technique in treatment of iliopsoas tightness. In this study Total 100 patients were randomly allocated to any one of the two treatment groups such that were 50 subjects in each treatment groups. Group A received muscle energy technique and group B received static stretching ROM (forward lumbar flexion, lumbar side flexion and lumbar Rotation) and MIT were measured both before and after immediate of treatment.

For group A pre and post treatment values of forward lumbar flexion, lumbar side flexion and lumbar Rotation) and MIT were measured using Wilcoxon signed rank test, showed extremely statistically significant changes giving a p- value < 0.000. Thus stating that MET (post isometric relaxation technique) has beneficial effects on improving (forward lumbar flexion, lumbar side flexion and lumbar Rotation) and MIT in iliopsoas tightness subjects.

Similarly, for group B pre and post treatment values of forward lumbar flexion, lumbar side flexion and lumbar Rotation) and MIT were measured using Wilcoxon signed rank test, showed extremely statistically significant changes giving a p- value < 0.000. Thus stating that static stretching technique has beneficial effects on improving (forward lumbar flexion, lumbar side flexion and lumbar Rotation) and MIT in iliopsoas tightness subjects.

When compared between groups (group A and group B), post treatment values (forward lumbar flexion, lumbar side flexion and lumbar Rotation) and MIT were measured using Man Whitney U Test, P- value for, which is considered to be statistically non-significantly for (forward lumbar flexion, lumbar side flexion and lumbar Rotation) and p-value for MLT was 0.00, which is considered to be statistically significant.

Similar studies from the evidence databases showed that the results are in line with the present study for Walidd Score, QOL SCALE and NPRS. The results of the study are discussed in and also compared with the previous studies. The possible explanations for the results are also discussed below according to supporting literature.

The study attempted to find out the effectiveness of muscle energy technique (post isometric relaxation) and static stretching on iliopsoas tightness. In the present study it was found that there is a statistically significant improvement in (forward lumbar flexion, lumbar side flexion and lumbar Rotation) and MLT within Group (A and B). Between the groups analysis found that there is no statistically significant difference between Group A and Group B in improvement (forward lumbar flexion, lumbar side flexion and lumbar Rotation), While there was a significant difference seen in values of MLT between both the groups A and B. Muscle energy techniques shows more improvement in increasing muscle length of iliopsoas muscle than static stretching.

Dr. Roopa Desai Conducted a comparative study on 30 subject were included to compare the muscle energy technique versus yoga Sana on iliopsoas tightness to improve flexibility and lumbar range of motion. Concluded that both Muscle energy testing and yoga Sana were

effective in improving flexibility of iliopsoas and lumbar range of motion while MET shows immediate effect and yoga Sana was more effective following 2 week intervention. The present study supports this literature as the presence study also shows the improve flexibility and lumbar range of motion in iliopsoas tightness in lumbar range of motion both MET and Static stretching group, There was no significant difference seen in lumbar range of motion between the groups, but there was significant difference seen in improving Muscle flexibility in muscle energy technique than static stretching group.

Claudia Puzzone Volpato *et al.* conducted a randomized clinical study involving 40 patients to compare the effects of stretching and strengthening of iliopsoas muscle associated with segmental stabilization versus stabilization alone in treatment of low back pain concluded that segmental stabilization alone or associated hip strengthening of iliopsoas prove more effective for improving lumbar pain and flexibility compare to static stretching. The present study supports this literature as the presence study also shows the improve flexibility and lumbar range of motion in iliopsoas tightness in lumbar range of motion both MET and Static stretching group, There was no significant difference seen in lumbar range of motion between the groups, but there was significant difference seen in improving Muscle flexibility in muscle energy technique than static stretching group. The present study is not associated with hip strengthening.

Suthichan Malai *et al.* [9] conducted a quasi-experimental study consisted 20 participants to determine the immediate effect of Hold-relax(HR) stretching of the iliopsoas muscle on pain, transvers abdominis(TrA) activation capacity, lumbar stability level, lumbar lordosis angle and iliopsoas muscle length in chronic nonspecific low back pain (CNSLBP) with lumbar hyper lordosis concluded that the HR of the iliopsoas muscle reduce pain and lumbar lordosis angle, enhance TrA activation, and increased length of hip flexor in CNSLBP with lumbar hyper lordosis. The present study supports this literature as the presence study also shows the improve flexibility and lumbar range of motion in iliopsoas tightness in lumbar range of motion both MET and Static stretching group, the present study was conducted only on iliopsoas tightness subject with restricted lumbar range of motion (forward flexion, side flexion and lumbar rotation).

The effects of MET for decrease in hip flexion tightness immediately after one intervention can be explained on the basis of physiological mechanisms behind the changes in muscle extensibility-reflex relaxation, viscoelastic changes as well as changes in stretch tolerance. Reflex muscle relaxation followed by immediate contraction that been proposed to occur by activation of the golgi tendon organs and their inhibitory influence on alpha- motor neuron pool.

The study also measured Lumbar flexion using the modified-Modified schober's Test where in, muscle energy technique was found to be more effective in improving lumbar rotation. The reason for both can be both soft tissue and articular component of the somatic dysfunction. The control of muscle tonic includes afferent information coming from mechanoreceptors of the articulations, periarticular structures, from the muscle spindle and golgi tendon organs, the information being then processes at spinal cord level causing contraction and relaxation of the muscle.

The mechanism follows stretching of the series of the elastic components of sarcomeres, increasing Range of motion. Clinically, iliopsoas stretching has been employed in lumbar spine disorders, justified on the premise that this may increase mobility of the area of the vertebral column. These assumption however were not confirmed in the present study, as patient treated with iliopsoas muscle stretching showed on improvement in columnar flexibility.

However, in spite of both groups (MET and Static stretching) showing improvement in lumbar flexibility and lumbar range of motion these results support MET(post isometric relaxation technique) as a positive manager of primary dysmenorrhea symptoms.

According to present study there may be no significant difference in the post value of lumbar range of motion (forward flexion, lumbar rotation, side lumbar flexion) between MET and Static stretching group, but MET group shows significant improvement in the lumbar flexibility in iliopsoas muscle.

Further Recommendations

The long term benefits of this treatment protocol could be established.

Conclusion

The present study concluded that both MET and Static Stretching technique are shown to have effect on improving lumbar range of motion and iliopsoas flexibility. The MET technique was found clinically more effective in improving iliopsoas flexibility than stretching in subjects with iliopsoas tightness. However there is no significant difference found in improving lumbar range of motion between both the groups MET and Static stretching group.

Limitations

It is a short duration study in which follow up was not done, therefore long term effects were not known. Randomized controlled trial is needed to find long term effects of both therapeutic exercises. There is lack of control group. Future research is required. Further study can be carried out to find the effect of MET and Static Stretching technique comparing with control group. Further study can be done measuring effect of these techniques on other outcome measures.

Conflict of interest: none declared

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