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ORIGINAL ARTICLE

EFFICACY OF MUSCLE ENERGY TECHNIQUE ON ILIOPSOAS MUSCLE TO REDUCE TIGHTNESS AND IMPROVE HIP EXTENSION RANGE OF MOTION AMONG DESKTOP WORKERS

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ABSTRACT

Background of the study: The Iliopsoas is a deep muscle group which anatomically connects the spine to the lower limbs. It is composed of the iliac us, Psoas major, Psoas minor muscles. It also plays a significant role as a pelvic and hip stabilizer. To study the effectiveness of muscle energy technique on Iliopsoas muscle to reduce tightness among desktop workers. Objective of the study is to find the effectiveness of muscle energy technique on Iliopsoas muscle to improve the hip extension range of motion and reduce tightness of Iliopsoas muscle among desktop workers. **Methods:** Sixty subjects who fulfilled the inclusion criteria were selected purposively and randomly assigned into two groups of 30 each. Group A (control) and Group B (experimental). Subjects were explained about the protocol, informed consent forms signed and obtained from the subjects before the intervention starts. Pre-test was conducted on both groups using modified Thomas test to measure Iliopsoas tightness and Goniometer to measure hip extension range of motion. Then post test score is obtained at after 3 Months from each group. **Results:** There was a significant difference in modified Thomas test right (t=2.219), left (t=2.617) and hip extension range of motion right (t=3.896), left (t=3.893) between control and experimental group with level of significance p≤0.05. Experimental group shows greater improvement Iliopsoas tightness and hip extension range of motion than control group. **Conclusion:** The study concluded that muscle energy technique helps to improve the Iliopsoas tightness and hip extension range of motion among desktop workers.

Keywords: Muscle energy technique, Iliopsoas tightness and hip extension range of motion, Modified Thomas test, Goniometer, desktop workers.

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INTRODUCTION

The iliopsoas is a deep muscle group which anatomically connects the spine to the lower limbs[1]. Iliopsoas is the primary hip flexor and is composed of psoas major, psoas minor and iliacus. The psoas major is made up of overlapping segmental fascicles that run lateral to the lumbar vertebrae, with attachments on the transverse processes and lateral bodies of vertebral segments T12-L5, as well as the discs in between.

The muscle attaches to the lesser trochanter of the femur and extends infero-laterally over the superior pubic rami, deep to the inguinal ligament. Iliacus is a triangular-shaped muscle that lies in the iliac fossa and is oriented more vertically than psoas. It passes over the anterior capsule of the hip joint, blends into the psoas major tendon, and inserts into the lesser trochanter. Because the Psoas minor attaches to the iliopectineal eminence on the pelvis and inserts at spinal segments T12 to L1, it is not directly involved in hip flexion[2]. Iliopsoas muscle plays a significant role as a pelvic and hip stabilizer and also important for daily activities, including sports. Impairments and pathology associated with this muscle group can cause significant limitations[1].

Flexibility defined as "the range of motion (ROM) available in joints or group of joints. Flexibility is influenced by number of factors, including gender, age, muscle size, and warm-up time. Females are more flexible than males with anatomic reasons such as pelvic anatomy, which might result in females having a bigger valgus angulation at the knee, accounting for the variations in flexibility. With aging and changes in muscle size, flexibility also tends to deteriorate[3]. Strength training is also thought to stimulate muscular growth hypertrophy and limit the development of flexibility[4]. Flexibility is an important component of physical conditioning program used as an adjunct to muscle strength and endurance training. Flexibility of the Iliopsoas muscle is necessary because flexibility allow the tissue to accommodate more easily to stress to abandoned shock impact and to improving the efficiency and effectiveness of the movement[5].

Over 2 million individuals are employed in modern Indian information techlnology (IT) and IT-enabled enterprises, and this figure is growing every day. The nature of sedentary labour has been the root cause of a wide range of musculoskeletal illnesses and discomforts that are grouped together as work-related musculoskeletal disorders (WRMSD). WRMSDs are disorders of the muscles, bones, and associated tissues that have been hypothesised to be caused by workrelated activities (particularly a repetitive activity). The most common musculoskeletal problems reported are pain (55%) and stiffness (14.8%), with the neck (44%) being the most afflicted, followed by the low back (30.5%), wrist/hand (19%), and shoulder (19%), (12.5%) [6].

Prolonged sitting is an extended period which put load on the muscle. It is becoming apparent that with sedentary nature of work for people in office jobs that is desktop workers, which is causing adaptive shortening, tightness that occur to a greater degree in hamstrings and iliopsoas associated with low back pain [7, 8]. Majority of male desk job professionals, with a long working history in their middle age shows 83.8% iliospoas muscle tightness[9].

The psoas and iliacus muscles are active when sitting[10], according to finewire EMG

investigation, however their activity is depending on the sitting posture [11]. The iliopsoas is a postural muscle that has been shown to have a tendency to shorten[12, 13]. As a result, it's possible that in some people, these muscles shorten as a result of a reduction in the number of sarcomeres in series, reducing the length at which maximum force production occurs[14]. This adaptation may improve postural control in sitting by allowing the hip flexor muscles to function at a shorter length. The muscle with large amount of force increases the risk of injury However, this may lead to altered postural control in standing, potentially increasing anterior pelvic tilt[15]. Many authors have reported that low back pain may occur as a result of excessive stress on lumbar spine and sacroiliac joints due to an exaggerated anterior pelvic tilt [16].

Some studies have shown that in individuals with LBP, there is also a decrease in the strength and lengthening of the iliopsoas, due to the attachment of this muscle with the pelvis and the lumbar spine. As a result of this attachment, the iliopsoas possibly has a stabilizing role in the column [17]. It is thought that tension in this muscle, formed by the union of the psoas major, psoas minor and the iliac[18] acts bilaterally with the insertion, causing an increase in lordosis, whereas weakening of the muscle reduces its size where both these conditions result in pain[17, 19]. Shortening of the Iliopsoas muscle can pull and twist the vertebrae, causing severe disc compression and herniation. Pain and discomfort in the lower back and SI joint region are signs of iliopsoas dysfunction[20].

Objectives of the study: To study the effectiveness of muscle energy technique on iliopsoas muscle to reduce tightness among desktop workers.To study the effectiveness of muscle energy technique on iliopsoas muscle to improve hip extension range of motion among desktop workers.

METHODOLOGY

Aim and Objectives: The study aims to find out the effectiveness of muscle energy technique on iliopsoas muscle to reduce tightness and improve hip extension range of motion among desktop workers.

It was an Experimental study and pre-test type. It included an experimental group and control group. Study Setting done at IT professionals in and around Kottayam.

Sample Size: 60 samples of population who satisfied the inclusion and exclusion criteria were selected.

Study Duration: The study was conducted over a period of three months.

Inclusion Criteria: Males with age group of 30-50 years, Participants with bilateral iliopsoas tightness (positive test) screened by Modified Thomas test, Desktop workers for at least 5 consecutive years with minimum of 5 hours /day.

Exclusion Criteria: History of any recent surgeries in low back and lower limbs in past 6 months, History of any recent musculoskeletal injuries like fractures, dislocations, joint instability or any soft tissue injuries in low back and lower limbs in past 6 months, Any congenital deformity of lower limb, Presence of tumours at hip that can restrict hip range of motion, Infective arthropathy at hip joint and pelvis.

Sampling Procedure: Purposive sampling

Data Collection: Sixty subjects who fulfilled the inclusion criteria were selected purposively and randomly assigned into two groups of 30 each. Group A (control) and Group B (experimental) subjects were explained about the protocol and informed consent forms were signed and obtained from the subjects.

Pre-test was conducted on both groups using modified Thomas test to measure iliopsoas tightness and goniometer to measure hip extension range of motion.

Group A (control) received conventional therapy for 20 minutes. Which include, iliopsoas muscle stretching exercise, the patient lies in a crook lying position with both lower limbs hanging off the end of the table, holding one knee to the chest; the therapist stand in front of both lower limbs. One hand held the flexed knee, while the other hand stretched the other leg by pushing down and holding the position for 30 seconds, then relaxing for 30 seconds, with 3 repetitions per set, 3 sets per visit. Same procedure repeated for other limb. Stretching is given for 3 times in a week for 6 weeks.

Group B (experimental) received muscle energy technique along with conventional therapy for 25 minutes. Subject is in prone lying with a pillow under the abdomen to reduce the lumbar curve and offering a stable pelvis. The practitioner stands adjacent to the participant at the end of the table facing the participant‟s experimental leg. The practitioner then placed their one hand over the participant‟s distal thigh just above the knee and their other hand over the participant‟s iliac crest to stabilize the pelvis. The practitioner flexes the knee and extends the hip once the barrier is identified the participant is asked to bring the thigh towards the table against resistance using 15-25% of their maximal voluntary contraction potential for 7-10 seconds. Then give the stretch and hold for 30 seconds; 3 sets per visit. Same procedure repeated for other limb. MET is given for 3 times in a week for 6 weeks.

Post-test was conducted on both Group A (control) and Group B (experimental) using modified Thomas test to measure iliopsoas tightness and goniometer to measure hip extension range of motion at the end of intervention phase. Pre-test and post-test data were analysed using paired t test and two sample t test as statistical tool.

Outcome measures: Modified Thomas Test and Goniometry

1) Modified Thomas Test (MTT): The subject sits at the very edge of the examination table, then rolls back onto the bench while pulling both knees to the chest. This is to ensure that the lumbar spine is flat on the bench and the pelvis is posteriorly rotated. The subject then holds the opposite hip in maximum flexion with the arms, while the limb to be tested is lowered towards the floor. For each side, angles are measured using a goniometer. The angle to be measured is the angle of hip flexion (reflecting the length of the Iliopsoas). The stationary arm of the goniometer is aligned with the lateral midline of the pelvis. The moving arm is aligned with the midline of the femur using the lateral epicondyle as a reference point and the angle is Repeat this procedure with the opposite side. If the thigh of the tested leg lies in horizontal position in which it is parallel to the floor, then indication is that Iliopsoas is not short. If the thigh rises

above the horizontal then indication is that Iliopsoas is short.

2. Goniometry (Hip Extension Range of Motion): Patient position, Prone, with lower extremities in anatomical position. Therapist stabilizes over posterolateral aspect of ipsilateral pelvis with palm of hand while fingers palpate ASIS. After instructing patient in motion desired, stabilize ipsilateral pelvis with one hand and extend patient‟s hip through available ROM with other hand. Ipsilateral knee should be kept extended to avoid limitation of hip extension by tight rectus femoris muscle. Hip should not be extended past the point at which pelvic motion begins to occur (as detected by inferior movement of ipsilateral ASIS under examiner‟s stabilizing hand). Return limb to starting position. Performing passive movement provides an estimate of the ROM and demonstrates to patient exact motion desired.

Goniometer alignment: Palpate following bony landmarks and align goniometer accordingly Stationary arm: Lateral midline of pelvis and trunk.

Axis: Greater trochanter of femur.

Moving arm: Lateral midline of femur toward lateral femoral epicondyle.

Read scale of goniometer.

Materials: Paper and pen, Couch, Universal Goniometer, Pillow

Plan of Analysis:
Paired t test: to compare the pre and post-test values of experimental and control group.
Two sample t test: To compare the post-test values of experimental group to the control group.

Funding: Own funding

RESULTS

Test	**Pretest**		**Post test**		**Mean Difference Score**	**Paired 't' test & p-value**
	Mean	**S.D**	**Mean**	**S.D**		
Control Group	13.17	3.12	11.60	3.04	1.57	**t = 15.099 p=0.0001, S*** **
Experimental Group	14.63	3.94	9.87	3.01	4.76	**t = 19.246 p = 0.0001,S*** **
Mean Difference score	1.46		1.73		*****p<0.001, *p<0.05 N.S – Not Significant**	
Student Independent 't' test & p-value	t = 1.598 p = 0.116 N.S		**t = 2.219 p = 0.030 S***			

Table 1: Comparison of pretest and post test modified Thomas test (FlexionRight) scores among desktop workers within and between Control and experimental group. N = 60(30+30)

The above table shows the comparison of pretest and post test modified Thomas test (Flexion-Right) within and between the Control and experimental group. Paired „t" test was computed to compare the pretest and post test modified Thomas test (Flexion-Right) scores and student independent „t" test was computed to compare the pretest and post test (Flexion-Right) scores between the groups.

The pretestmean score in the control group was 13.17±3.12 and the post test mean score was 11.60±3.04. It was found that the calculated paired „t" test value for t=15.099 was found to be statistically significant p<0.001 level. This clearly infers that there was significant improvement in the modified Thomas test (Flexion-Right) scores among the desktop workers in the control group.

The pretest mean score in the experimental group was 14.63±3.94 and the post test mean score was 9.87±3.01. It was found that the calculated paired „t" test value for t=19.246 was found to be statistically significant p<0.001 level. This clearly infers that after the intervention of muscle energy technique among the desktop workers significant improvement in the modified Thomas test (FlexionRight) scores was observed among the desktop workers in the experimental group.

The table also shows that the calculated student independent „t" test value for t=1.598 in the pretest was not found to be statistically significant. This clearly infers that there was no significant difference in the level of flexion – right scores between the groups at the pretest level.

The table also shows that the calculated student independent „t" test value for t=2.219 in the post test was found to be statistically significant at p<0.05 level. This clearly infers that there was a significant difference in the level of flexion – right scores between the groups at the post test level in which the desktop workers in the experimental group had better improvement than the desktop workers in the control group.

Test	**Pretest**		**Post test**		**Mean Difference Score**	**Paired 't' test & p-value**
	Mean	**S.D**	**Mean**	**S.D**		
Control Group	13.20	3.19	11.63	3.07	1.57	**t = 13.706 p = 0.0001,S*** **
Experimental Group	14.57	3.87	9.63	2.85	4.94	**t = 17.929 p = 0.0001, S*** **
Mean Difference score	1.37		2.0		*****p<0.001, *p<0.05 N.S – Not Significant**	
Student Independent 't' test & p-value	t = 1.492 p = 0.141 N.S		**t = 2.617 p = 0.011 S***			

Table 2: Comparison of pretest and post test modified Thomas test (FlexionLeft) within and between Control and Experimental group. , N = 60(30+30)

The above table shows the comparison of pretest and post test modified Thomas test (Flexion-Left) within and between the Control and experimental group. Paired „t" test was computed to compare the pretest and post test modified Thomas test (Flexion-Left) scores and student independent „t" test was computed to compare the pretest and post test (Flexion-Left) scores between the groups.

The pretest means score in the control group was 13.20±3.19 and the post test means score was 11.63±3.07. It was found that the calculated paired „t" test value for t=13.706 was found to be statistically significant p<0.001 level. This clearly infers that there was significant improvement in the modified Thomas test (Flexion-Left) scores among the desktop workers in the control group.

The pretest mean score in the experimental group was 14.57±3.87 and the post test mean score was 9.63±2.85. It was found that the calculated paired „t" test value for t=17.929 was found to be statistically significant p<0.001 level. This clearly infers that after the intervention of muscle energy technique among the desktop workers significant improvement in the modified Thomas test (FlexionLeft) scores was observed among the desktop workers in the experimental group.

The table also shows that the calculated student independent „t" test value for t=1.492 in the pretest was not found to be statistically significant. This clearly infers that there was no significant difference in the level of flexion – left scores between the groups at the pretest level.

The table also shows that the calculated student independent „t" test value for t=2.617 in the post test was found to be statistically significant at p<0.05 level. This clearly infers that there was a significant difference in the level of flexion – left scores between the groups at the post test level in which the desktop workers in the experimental group had better improvement than the desktop workers in the control group.

Test	**Pretest**		**Post test**		**Mean Difference Score**	**Paired 't' test & p-value**
	Mean	**S.D**	**Mean**	**S.D**		
Control Group	24.33	2.96	26.0	3.09	1.67	**t = 16.699 p = 0.0001, S*** **
Experimental Group	23.53	3.32	29.10	3.08	5.57	**t = 33.967 p = 0.0001, S*** **
Mean Difference score	0.80		3.10		*****p<0.001 N.S – Not Significant**	
Student Independent 't' test & p-value	t = 0.985 p = 0.329 N.S		**t = 3.896 p = 0.0001 S*** **			

***p<0.001, **p<0.01, S – Significant

Table 3: Comparison of pretest and post test hip extension range of motion (Right) within and between Control and Experimental group. N = 60(30+30)

The above table shows the comparison of pretest and post test hip extension range of motion (Right) within and between the Control and experimental group.

Paired „t" test was computed to compare the pretest and post test hip extension range of motion (Right) scores and student independent „t" test was computed to compare the pretest and post test hip extension range of motion (Right) scores between the groups.

The pretest means score in the control group was 24.33±2.96 and the post test mean score was 26.0±3.09. It was found that the calculated paired „t" test value for t=16.699 was found to be statistically significant p<0.001 level. This clearly infers that there was significant improvement in the hip extension range of motion (Right) scores among the desktop workers in the control group.

The pretest means score in the experimental group was 23.53±3.32 and the post test mean score was 29.10±3.08. It was found that the calculated paired „t" test value for t=33.967 was found to be statistically significant p<0.001 level. This clearly infers that after the intervention of muscle energy technique among the desktop workers significant improvement in the hip extension range of motion (Right) scores was observed among the desktop workers in the experimental group.

The table also shows that the calculated student independent „t" test value for t=0.985 in the pretest was not found to be statistically significant. This clearly infers that there was no significant difference in the level of hip extension range of motion (Right) between the groups.

The table also shows that the calculated student independent „t" test value for t=3.896 in the post test was found to be statistically significant at p<0.001 level. This clearly infers that there was significant difference in the level of hip extension range of motion (Right) between the groups.

Test	**Pretest**		**Post test**		**Mean Difference Score**	**Paired 't' test & p-value**
	Mean	**S.D**	**Mean**	**S.D**		
Control Group	24.33	2.96	26.0	3.05	1.67	**t = 16.699 p = 0.0001, S*****
Experimental Group	23.60	3.41	29.07	3.05	5.47	**t = 27.873 p = 0.0001, S*****
Mean Difference score	0.73		3.07		*****p<0.001 N.S – Not Significant**	
Student Independent 't' test & p-value	t = 0.889 p = 0.378 N.S		**t = 3.893 p = 0.0001 S*****			

***p<0.001, **p<0.01, S – Significant

Table 4: Comparison of pretest and post test hip extension range of motion (Left) within and between Control and Experimental group. N = 60(30+30)

The above table shows the comparison of pretest and post test hip extension range of motion (Left) within and between the Control and experimental group.

Paired „t" test was computed to compare the pretest and post test hip extension range of motion (Left) scores and student independent „t" test was computed to compare the pretest and post test hip extension range of motion (Left) scores between the groups.

The pretest mean score in the control group was 24.33±2.96 and the post test mean score was 26.0±3.09. It was found that the calculated paired „t" test value for t=16.699 was found to be statistically significant p<0.001 level. This clearly infers that there was significant improvement in the hip extension range of motion (Left) scores among the desktop workers in the control group.

The pretest mean score in the experimental group was 23.60±3.41 and the post test mean score was 29.07±3.05. It was found that the calculated paired „t" test value for t=27.873 was found to be statistically significant p<0.001 level. This clearly infers that after the intervention of muscle energy technique among the desktop workers significant improvement in the hip extension range of motion (Left) scores was observed among the desktop workers in the experimental group.

The table also shows that the calculated student independent „t" test value for t=0.889 in the pretest was not found to be statistically significant. This clearly infers that there was no significant difference in the level of hip extension range of motion (Left) between the groups.

The table also shows that the calculated student independent „t" test value for t=3.893 in the post test was found to be statistically significant at p<0.001 level. This clearly infers that there was significant difference in the level of hip extension range of motion (Left) between the groups.

Post modified Thomas test(right)	**Number**	**Mean**	**S.D**	**Value of t statistic**	**d.f**	**Significance**
Group A	30	11.60	3.04	2.219	58	0.030
Group B	30	9.87	3.01			**Significant**

Table 5: Comparison of the Post modified Thomas test (right) Values of the two groups

The above table also shows that the calculated student independent„t" test value for t=2.219 in the post test was found to be statistically significant at p<0.05 level. This clearly infers that there was a significant difference in the level of flexion – right scores between the groups at the post test level in which the desktop workers in the experimental group had better improvement than the desktop workers in the control group.

Post modified Thomas test(right)	Number	Mean	S.D	Value of t statistic	d.f	Significance
Group A	30	11.63	3.07	2.617	58	0.011
Group B	30	9.63	2.85			**Significant**

Table 6: Comparison of the Post modified Thomas test (left) of the two groups

The above table also shows that the calculated student independent „t" test value for t=2.617 in the post test was found to be statistically significant at p<0.05 level. This clearly infers that there was a significant difference in the level of flexion – left scores between the groups at the post test level in which the desktop workers in the experimental group had better improvement than the desktop workers in the control group.

Post hip extension range of motion(right)	Number	Mean	S.D	Value of t statistic	d.f	Significance
Group A	30	26.0	3.09	3.896	58	0.001
Group B	30	29.10	3.08			**Significant**

Table 7: Comparison of the Post hip extension range of motion (right) Values of the two groups

The above table also shows that the calculated student independent „t" test value for t=3.896 in the post test was found to be statistically Significant at p<0.001 level. This clearly infers that there was significant difference in the level of hip extension range of motion (Right) between the groups.

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Post hip extension range of motion (left)	Number	Mean	S.D	Value of t statistic	d.f	Significance
Group A	30	26.0	3.05	3.896	58	0.0001
Group B	30	29.07	3.05			**Significant**

Table 8: Comparison of the Post hip extension range of motion (left) of the two groups

The above table also shows that the calculated student independent „t" test value for t=3.893 in the post test was found to be statistically significant at p<0.001 level. This clearly infers that there was significant difference in the level of hip extension range of motion (Left) between the groups.

Demographic Variables Distribution between Groups

Group	Age		Height		Weight	
	Mean	S.D	Mean	S.D	Mean	S.D
Control Group	42.37	6.53	169.30	5.86	65.63	7.98
Experimental Group	42.10	5.59	165.77	4.27	61.30	4.48

Table 9: Comparison of mean and standard deviation of demographic variables of the samples in the Control group and Experimental group**,** N = 60(30+30)

The table 9 shows that the mean age of samples in the Control Group A was 42.37±6.53 and in the Experimental Group the means age of the samples was 42.10±5.59.

The mean height of samples in the Control Group was 169.30±5.86 and in the Experimental Group the means height of the samples was 165.77±4.27.

The mean weight of samples in the Control Group was 65.63±7.98 and in the Experimental Group the means height of the samples was 61.30±4.48.

GENDER WISE DISTRIBUTION OF SUBJECTS BETWEEN GROUPS

Group	Sex	
	Frequency	Percentage
Control Group	30	100.0
Experimental Group	30	100.0

Table 10: Frequency and percentage distribution of gender of the samples in the Control group and Experimental group, N = 60(30+30)

The table 10 shows that the all 30(100%) were male both in the control and experimental group.

DISCUSSION

The research was an experimental study which was conducted to investigate the efficacy of muscle energy technique on iliopsoas muscle to reduce tightness and improve hip extension range of motion among desktop workers.

60 subjects who fulfilled the inclusion criteria were selected purposively and randomly assigned into two groups of 30 each. Group A (control) and Group B (experimental) subjects were explained about the protocol, informed consent forms were signed and obtained from the subjects. Subjects in group A received stretching of iliopsoas muscle and subjects in group B received muscle energy technique. The pre-test and post -test data was collected using modified Thomas test and goniometer. All subjects well tolerated the intervention given and no one was dropped out of the study.

The result shows that there is a significant improvement in post-test experimental group, mean value of Modified thomas test right were from 14.63 to 9.87, shows high significance with the t value of 2.219 and p value 0.030. Similarly, modified thomas test left of post-test experimental group with a mean improvement value from 14.57 to 9.63 and shows significant with the t value of 2.617 and p value 0.011. While, hip extension range of motion right of experimental group with a mean improvement value from 23.53 to 29.10 and is significant with the t value of 3.896 and p value 0.0001. The study result shows significant- difference in post-test group of experimental group and control group with 5% level of significance. So, there is statistically significant improvement in iliopsoas muscle tightness and hip extension range of motion among desktop workers. Hence the study concluded that muscle energy technique has improvement in iliopsoas tightness and hip extension range of motion among desktop workers.

Shiwani Nitin redij found that 3 weeks of muscle energy technique showed significant improvement in iliopsoas tightness. It is due to MET involves enhanced mobility. The mechanism occurs during isometric contraction there is stretching of the series of elastic components of sarcomeres, which increases their length, particularly if active or passive stretching follows after MET [21,22].

To increase a muscle's extensibility and range of motion (ROM), MET uses repeated, submaximal active resisted isometric contractions followed by passive stretching (Talapalli Radhika et al., 2014). Sapna Chaudhary et al, Study was design to obtain a more understand about which method more effective MET (PIR) or static stretching in Iliopsoas tightness. This study suggested that both the techniques effective for improving Iliopsoas flexibility, but MET (PIR) technique were highly significant in increasing the flexibility of Iliopsoas than static stretching [23].

Our study finding also supported by Rashad Ahmed et al. suggested that the MET and dynamic stretching showed significant improvement in hamstring tightness. But MET was significantly more effective than dynamic stretching in healthy individuals with hamstring tightness. MET is more effective compared to static stretching because MET increases ROM faster rate due to active and precise recruitment of muscle fibers activity [24].

Single application of Muscle Energy Technique changes in ROM due to viscoelastic Tissue response within the elastic range in which the stretched tissue does not immediately return to its original length (Lederman 2005; Magee

et al., 2007). Ballantyne et al., (2003) suggest that if increases in ROM following MET were due to changes in viscoelastic properties alone, allowing Greater muscle extensibility, this would be accomplished with a constant torque or force of stretch[25].

The increases in ROM measured for the MET stretch compared to the passive stretch protocol were assessed with a constant force of stretch, supporting Lederman's (2005) theory that increased gains in ROM for CR stretch techniques may be due to the stretch focusing on the stiffer in series connective tissue elements of the muscle tissue, as well as the more elastic parallel connective tissues primarily targeted during passive stretch. A more favoured explanation is that an increase in stretch tolerance occurs as a result of CR procedures (Magnusson et al., 1996; Ballantyne et al., 2003). It is possible that an incr ease in stretch tolerance may have allowed for greater relaxation of the participants in the modified. Thomas test position used for intervention and assessment and thus achieve a greater degree of hip extension[26, 27].

Jalaps k et al, conducted a study to find out immediate effect of MET on pectoralis minor tightness in Healthy Collegiate Individuals. In this study, the Results showed that there is statistically significant ($p< 0.05$) reduction in pectoralis minor tightness in healthy collegiate individuals after applying MET for pectoralis minor muscle[28].

Prerana et al, the effects of MET component for increase in CROM post intervention can be explained on the basis of physiological mechanisms behind the changes in muscle extensibility-reflex relaxation, viscoelastic changes, and changes to stretch tolerance. Reflex muscle Relaxation following contraction that has been proposed to occur by activation of Golgi tendon organs and their inhibitory influence on the α-motor neuron pool. Combination of contractions and stretches might be more effective for producing viscoelastic change than passive stretching, because greater forces could produce increased viscoelastic change and passive extensibility[29].

In this study, the experimental group after muscle energy technique on iliopsoas muscle showed improvement in iliopsoas tightness and hip extension range of motion. The main physiological mechanism proposed for MET is post isometric relaxation, which causes a reduction in antagonist muscle tone following an isometric contraction, and reciprocal inhibition, which involves a reduction in antagonist muscle tone following the isometric contraction of the agonist muscle through the inhibition of alpha motor neuron[30].

MET employs muscle contraction by the patient followed by relaxation and stretch of an antagonist or agonist (hurtling et al., 1996). It is a mobilizing approach that employs autogenic inhibition of the golgi tendon organ (GTO). Autogenic inhibition occurs when the golgi tendon organ, which responds to changes in muscle tension and length, is activated, preventing some muscles from contracting. PostIsometric on (PIR) works on the concept of autogenic inhibition. Subsequent reduction is in tone of the agonist muscle after isometric contraction. This occurs due to stretch receptors called Golgi Tendon organs that are located in the tendon of the agonist muscle. (Webster et al., 2001). During PIR, the golgi tendon organ triggered by a powerful muscle contraction against an equal counterforce. The afferent nerve impulse from the Golgi tendon organ enters the dorsal root of the spinal cord

and meets with an inhibitory motor neuron. This stops the discharge of the efferent motor neuron‟s impulse and therefore prevents further contraction, the muscle tone decreases, which in turn results in the agonist relaxing and lengthening (Webster et al., 2001). The basic concept of PIR is to contraction of tense muscle isometric and then muscle encourage to lengthen during a period of complete voluntary relaxation. Gravity is used to encourage release of muscle tension and taken up to the slack[31].

The most common form of MET is isometric contraction of the largest muscle at end range followed by passive stretch to the new barrier. Contract relax (CR) or post isometric relaxation are two terms used to characterize this active stretch process (PIR). Other types of active stretch related with MET include contraction of the agonist at the end range of the antagonist muscle, followed by passive stretch of the antagonist, a sequence known as agonist contract relax (ACR), which is based on the reciprocal inhibition principle (RI). These two techniques have also been combined into a contract relax agonist contract relax (CRAC) combination, which is followed by passive stretching[32].

MET is more effective compared to static stretching because MET increases ROM faster rate due to active and precise recruitment of muscle fibers activity. Might be due to these effects the muscle energy technique is effective in improving iliopsoas muscle tightness and hip extension range of motion among desktop workers along with conventional therapy[33].

Limitations of the study were only middle-aged desktop workers were included in this study, so the result of this study cannot be generalized over all the age groups and suggests further studies it can be done in the younger and older age group as well. Sample size was very small, future study with large sample size is needed to confirm the findings. Future study can do with other variables also. Study duration was very less; in future studies can be done with more study duration. Only males' participants were included in this study, further it can be done with both genders.

CONCLUSION

The study was to evaluate the effectiveness of muscle energy technique on iliopsoas muscle to reduce tightness and improve hip extension range of motion among desktop workers. The result of the study shows that there is statistically significant difference between experimental group and control group. After analyzing the study it can be concluded that muscle energy technique helps to improve iliopsoas muscle tightness and hip extension range of motion among desktop workers.

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