An Immediate Effect of Neurodynamic Mobilization of Femoral Nerve vs Post Isometric Relaxation on Flexibility for Desk Worker with Iliopsoas Muscle Tightness-A Pilot Study

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Abstract

**Background:** A sedentary lifestyle can contribute to numerous issues, such as muscle tightness, reduced joint range of motion, and diminished flexibility, adversely impacting an individual's daily activities. Those engaged in occupations involving prolonged sitting, such as computer professionals or desk workers, are particularly susceptible to adaptive changes that may result in the shortening of hip muscles. The iliopsoas muscle, in particular, is not frequently stretched during routine daily activities, making it prone to developing tightness.

**Methods:** 20 patients were included in the study, divided into two groups: Group A and Group B. 10 patients in each Group. Group A was given the isometric relaxation technique and Group B was given neurodynamic mobilization of the femoral nerve. Iliopsoas tightness is assessed using the modified Thomas test. The data was analyzed using SPSS version 25.

**Results:** Within-group analysis suggested that post isometric relaxation group's pre-mean value was 17.8 and Post-mean was 12.4, In group B, the Pre-mean value was 19.2 and Post-mean was 13 (p<0.05). Furthermore, in Between-group analysis group A post mean was 12.4, In group B, the post mean was 13. Thus, the result suggested that Group B is more effective than group A.

**Conclusion:** The present study concluded that both techniques improve the flexibility of the iliopsoas muscle, but the neurodynamic mobilization of the femoral nerve has a more significant effect than post-isometric relaxation.

**Keywords:** Modified Thomas test, Neurodynamic, Femoral nerve, Post-isometric relaxation

Introduction

Living a sedentary lifestyle poses a significant risk for a range of preventable diseases, negatively impacting one’s quality of life. This inactive way of life can result in issues such as muscle tightness, reduced joint mobility, and diminished flexibility, hindering the day-to-day activities of individuals. For instance, those who spend prolonged hours sitting, such as desk workers or students, undergo adaptive changes that can lead to the shortening of hip muscles (1).

Extended periods of sitting exert a prolonged strain on muscles, heightening the risk of injuries. Research underscores that the sedentary nature of desk work contributes to adaptive shortening and tightness, particularly in the muscles surrounding the hip joint. These adaptations are closely associated with an elevated risk of experiencing low back pain. Within the hip joint, pivotal muscles such as the Hamstrings, Iliopsoas, and Piriformis are particularly prone to reduced flexibility, especially among individuals engaged in prolonged desk jobs (1).

A notable 96.7% manifested tightness in the Hamstrings, 83.8% in the Iliopsoas, and 38% in the Piriformis. These findings imply that a considerable percentage of middle-aged professionals engaged in desk jobs with extensive work experience may develop muscle tightness in these specific areas. As a result, they become more prone to experiencing symptoms associated with low back pain or other issues related to the back or hip over the course of their lives (2).

Due to the numerous transformations in the workforce, an escalating trend is observed in the proliferation of roles in the contemporary world that necessitate workers to remain seated for extended periods, promoting a more sedentary lifestyle. Government data, as disclosed in the “Occupational Requirements Survey 2017,” categorizes office and administrative positions as sedentary, with employees spending approximately 65.6% of their workday seated. Professional occupations exhibit a higher sedentary nature, with individuals sitting for 78.1% of the working day. In specific fields such as math and computer-related professions, the sedentary aspect is even more pronounced, with employees spending around 83.5% of their workday seated. Likewise, these
engaged in business and finance operations experience a substantial sedentary work environment, with an average of 80.6% of their day spent sitting (3).

When you sit, a significant portion of your body weight is transferred to the pelvis, specifically the ischial tuberosity. Proper posture is crucial as it relies on muscles to counteract gravity. The core stability muscles, including the rectus abdominis, iliocostalis lumborum, and multifidus muscles deep in the abdomen, pelvis, and back, play a key role in maintaining an upright posture. Prolonged sitting with poor posture can lead to stiffness and weakness in these muscles, contributing to lower back pain. Additionally, the tough fascia, while inherently pliable, can adopt the shape of a sustained faulty posture over time (3).

Flexibility pertains to the ability of muscles, joint capsules, ligaments, and tendons to stretch. Its significance lies in preventing orthopedic problems later in life, particularly addressing concerns such as lower back pain. Adequate muscle flexibility supports proper pelvic rotation, reduces disc compression, and safeguards against undue stretching of muscles. Within the domain of physical and health-related fitness, flexibility plays a crucial role. Insufficient flexibility is correlated with challenges in performing and maintaining a spectrum of routine activities (3).

The flexibility of the iliopsoas muscle is crucial because it enables the tissue to adjust more effortlessly to stress, absorb shock impact effectively, and enhance the overall efficiency of movement. In other words, when the iliopsoas muscle is flexible, it can better adapt to various stresses, absorb shocks more efficiently, and contribute to smoother and more effective movements in the body (3).

The iliopsoas is a unique muscle group in the body, as it directly connects to the spine, pelvis, and femur. This distinctive feature allows it to play a significant role in influencing and being influenced by movements in both the spine and hip joints. Functioning as a postural muscle, the iliopsoas has been noted for its notable inclination to undergo shortening (4).

The iliopsoas musculotendinous unit (IPMU) is made up of the main and minor psoas muscles, as well as the iliacus muscle. The iliopsoas muscle is also known as the hip muscle. This complex muscle system can work as a whole or as individual muscles. It is necessary for proper standing or sitting lumbar posture, for stabilizing the Coxo-femoral joint, and for walking and running. The fascia that covers the iliopsoas muscle forms several fascial connections that connect the muscle to various viscera and muscular regions (5).

The Iliopsoas muscle rarely experiences stretching in everyday activities, resulting in tightness. As the most potent hip joint flexor, this muscle plays a crucial role in pelvis movement and stabilization. Tightness in the Iliopsoas has a strong association with back pain. A shortened iliopsoas group can cause the spine to arch excessively and the pelvis to tilt forward, placing strain on all spinal muscles, including the erector spinae. The reduced length of the iliopsoas muscle can pull and twist the vertebrae, leading to excessive compression of the discs and ultimately causing disc herniation. Dysfunction of the Iliopsoas manifests as symptoms such as pain and discomfort in the lower back and SI joint area (6).

Individuals with tight iliopsoas muscles, in comparison to those with stable ones, show notably reduced strength in the iliopsoas, limited range of motion in hip extension, heightened pelvic tilting, and increased lumbar lordosis. When the muscle is stretched while lying down with the knees semi-flexed, it not only enhances muscle flexibility but also tends to cause the pelvis to shift backward and return to a neutral position (7).

Desk workers are prone to experiencing tightness in the iliopsoas. Numerous studies have demonstrated that interventions such as high-frequency diathermy, myofascial release, strain counter strain, and stretching can alleviate iliopsoas tightness. Consequently, the objective of this study is to assess the immediate impact of neurodynamic femoral nerve mobilization compared to post-isometric relaxation on flexibility in desk workers exhibiting iliopsoas tightness.

Materials and Methods

The study was conducted after obtaining institutional ethical authorization. The Population were distributed using a basic simple random sampling approach.

Participants

A comparative study was conducted on 20 participants with iliopsoas tightness and immediate effect was seen. The study included both genders, ages between 24-55 years, Working hours of a minimum of eight hours/day (3). History of the trauma of the lumbar spine, pelvic inflammatory condition, presence of a tumor that affects hip motion, and any congenital deformity of the lower limb was Excluded from the study (1,6). The tightness of the Iliopsoas muscle was assessed by the Modified Thomas test.
In the adapted Thomas test, the patient is positioned supine, ensuring that the buttocks are brought as close to the end of the table as feasible. The non-tested leg is held in flexion at both the hip and knee by the patient. Full flexion of the hip is employed to sustain complete rotation of the pelvis while maintaining a flat lumbar spine.

The assessment involves observing the positioning of the tested thigh. If the thigh lies horizontally, parallel to the floor, it signifies that the iliopsoas is not shortened. Conversely, if the thigh elevates above the horizontal position, it indicates a shortening of the iliopsoas muscle.

**Study design**

The research was initiated following approval from the institutional review board. Commencing the study, written consent was obtained from each participant. Based on the predefined inclusion criteria, the participants were categorized into two groups. Specifically, Group A (N=10) underwent post-isometric relaxation, while Group B (N=10) received neurodynamic mobilization targeting the femoral nerve. Pre-intervention and post-intervention assessments were conducted to measure the outcomes.

**Group A post-Isometric Relaxation Group**

Post-isometric relaxation was administered to a cohort of 10 desk workers. The prescribed procedure commenced with the patient assuming a supine position at the periphery of the table. The non-tested leg was positioned in flexion at both the hip and knee, while the experimental thigh and leg were suspended at the edge of the table. Simultaneously, the knee of the opposite thigh was extended up to a predetermined barrier.

Following this positioning, the patient engaged in a controlled flexion of the hip against minimal resistance in an isometric manner, concomitant with a deliberate inhalation lasting 7 seconds. Subsequent to this phase, the patient was instructed to “relax” and exhale gradually. A pause of 5 seconds ensued, allowing ample time for the relaxation response to manifest. This comprehensive sequence of actions was reiterated thrice as part of the overall procedural protocol (6).

**Group B Neurodynamic Mobilization Of Femoral Nerve**

Group B involves 10 desk workers. The patients were positioned in a side-lying posture. The therapy session commenced with the application of the neural slider technique. In this method, the patient, lying on the non-affected side, was instructed by the therapist to flex the knee of the upper leg, bringing the heel towards the buttock and experiencing a stretch in the thigh. Simultaneously, the therapist executed extension and adduction of the patient’s top hip, enhancing lumbar lordosis until the foot touched the bed within the limits of pain.

The subsequent neural tensioner technique involved similar steps, with the additional instruction for the patient to grasp their ankle and gently pull with the therapist’s assistance. This action caused the patient’s knee to move backward and the hip to extend, inducing a stretch. The patient was then prompted to relax and repeat the action while maintaining the stretch. Each repetition included a 30-second hold, followed by 60 seconds of relaxation. These advanced techniques were systematically applied during the therapy session for the specified group (8,9).

**Statistical Analysis Methods**

The 20 desk workers were evaluated by modified Thomas test. Pre and post data were analysed. The SPSS version 25 was used for the checking normality of distribution. Within-group analysis was done by paired t-test and between-group analysis was done by unpaired t-test. The confidence interval for the study was kept at 95%. Significance level was kept <0.05.

**Result**

Table 1 suggested mean age difference for both groups. Group A mean age was 26.5 and Group B mean age was 27.5.

Table 1. Mean age distribution for Group A and Group B

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>26.5</td>
<td>27.5</td>
</tr>
<tr>
<td>SD</td>
<td>3.219</td>
<td>2.598</td>
</tr>
</tbody>
</table>

Table 2 suggested that group A consisted of 7 males and 3 females and group B consisted of 5 in each group.
Table 2: Gender distribution for Group A and Group B

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Group B</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 3 which suggested that Within groups analysis of groups A and B suggested statistically significant differences in all the outcome measures. Pre-post analysis of data shows p value less than 0.05.

Table 3. Within groups analysis of outcome measures

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Std. deviation</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modified Thomas pre-A</td>
<td>17.8</td>
<td>2.33</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Modified Thomas post-A</td>
<td>12.4</td>
<td>1.56</td>
<td></td>
</tr>
<tr>
<td>Modified Thomas pre-B</td>
<td>19.2</td>
<td>3.40</td>
<td></td>
</tr>
<tr>
<td>Modified Thomas post-B</td>
<td>13</td>
<td>3.19</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 4 suggests that Between-group analysis of groups A and B. Between-group analysis suggested that the groups did not show a statistically significant (p >0.005) effect on tightness.

Table 4. Between-group analysis of outcome measures

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Group A</th>
<th>Group B</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modified Thomas test</td>
<td>Mean</td>
<td>SD</td>
<td>P value</td>
</tr>
<tr>
<td></td>
<td>12.4</td>
<td>1.56</td>
<td>0.278</td>
</tr>
</tbody>
</table>

Discussion

Individuals who spend prolonged durations in a seated position, particularly those involved in desk jobs, experience adaptive changes that can lead to the shortening of hip muscles. People with sedentary lifestyles often complain of lower back pain issues, stemming from muscular imbalances that develop due to extended periods of sitting. Spending eight hours or more in a chair can result in tightness in various muscles, including the hamstrings, iliopsoas, piriformis, and others. This muscular tightness places strain on joints, as these muscles remain contracted to support the sitting posture, contributing to discomfort and the potential emergence of long-term health issues (2).

A prior investigation conducted by Pradip B et al. established a noteworthy prevalence of hip tightness among males who are consistently involved in prolonged desk jobs. The findings revealed pronounced tightness in the hamstring, iliopsoas, and piriformis muscles. Consequently, it is inferred that a substantial number of professionals engaged in desk jobs tend to develop muscle tightness, rendering them more susceptible to experiencing low back pain and other symptoms associated with the back or hip. The study thus supports the notion that individuals with desk-based occupations are at an increased risk of developing hip tightness, potentially leading to various musculoskeletal issues (2).

In this study, the between-group analysis indicated that neither group demonstrated statistically significant differences (p>0.05) in reducing tightness. However, within-group analysis revealed that the pre-mean of group A was 17.8, and the pre-mean of group B was 19.2. The post-mean for group A decreased to 12.4, while for group B, it decreased to 13. This suggests that neurodynamic mobilization of the femoral nerve, represented by group B, is effective in reducing tightness within the group, despite the lack of significant differences when comparing the two groups.

According to Sapna Chaudhary In the Post-Isometric Relaxation (PIR) method, the Golgi Tendon Organ (GTO) is triggered through a forceful muscle contraction against a counterforce. Following this contraction, the GTO initiates a pathway by entering the dorsal root of the spinal cord, where it interacts with an inhibitory motor neuron. Consequently, the efferent motor neuron impulse is interrupted, preventing further contraction and reducing muscle tone. This interruption in the motor neuron signal leads to the relaxation and elongation of the agonist muscles. In simpler terms, the PIR method exploits the body’s neurophysiological response to a powerful muscle contraction, leveraging the GTO mechanism to induce muscle relaxation and lengthening (9).

PIR’s fundamental concept is to contract stiff muscles isometrically before encouraging them to lengthen during a period of total voluntary relaxation. Muscle tension is released and taken up to the slack by using gravity (10).
An Immediate Effect of Neurodynamic Mobilization of Femoral Nerve vs Post Isometric Relaxation on Flexibility

Limited evidence suggests that when a muscle is held in a lengthened position for an extended period, it adapts by increasing the number of sarcomeres in series, a process known as myofibrilllogenesis. The prevailing theory posits that the addition of sarcomeres occurs to sustain the optimal functional overlap of actin and myosin filaments within the muscle. This adaptation may result in a permanent form of lengthening if the newly gained length is regularly utilized in functional activities (11).

In 2014, Talapalli and Sheth et al. reported mixed results regarding Proprioceptive Neuromuscular Facilitation (PNF) techniques. Specifically, they found that reciprocal inhibition (RI) demonstrated superior effects compared to other PNF techniques on muscle flexibility (12).

According to Coppieters et al., neural sliders lengthen the nerve bed at one end, which causes pressure to build up in the nerve from that end while concurrently relieving tension from the other end. By doing this, the study is promoted without causing tension to build up. This excursion results in the dispersion of intraneurual fluid, which lowers intraneural edema, alleviating hypoxia and enhancing axonal transmission. NDS also helps to restore tissue mobility, lessens neural mechanosensitivity, and lowers the pressure brought on by intraneural and extra-neural fibrosis. It lessens the antidromic impulses produced in the malfunctioning type C-fibers, which cause neuropeptides to be released and tissue inflammation to follow. There is improvement in viscoelastic properties of the nerve, leading to a reduction in pain thus reducing disability (13).

According to Islam et al., Effectiveness of neural mobilization versus static Stretching for the treatment of radiating low back pain patients, 42 participants were selected randomly. In this study, the result shows a significant improvement in more reduction of pain in Group A by using Neural Mobilization with conventional physiotherapy & more reduction of disability in Group B by using Static Stretching with conventional physiotherapy. The result of this study suggest that both Neural Mobilization with conventional physiotherapy and Static Stretching with conventional physiotherapy was effective for radiating low back pain patients but Neural Mobilization was more effective than Static Stretching in reducing pain but Static Stretching was more effective in reducing disability than Neural Mobilization (14).

In this study, the goniometer is used to check the tightness of the iliopsoas. So, Phyllis A. et al. examined the reliability of inclinometer and goniometric measurements of hip extension flexibility by using the modified Thomas test. 42 healthy subjects were used for this study. The modified Thomas test was performed on each subject using both an inclinometer and a goniometer. The results showed that the two instruments can be used interchangeably for measuring hip extension flexibility. Hence it is concluded that the high correlations found in the study provide strong evidence that the inclinometer and goniometer are reliable instruments for measuring hip extension flexibility (2).

The widespread prevalence of hamstring and iliopsoas tightness requires the incorporation of measures for awareness and prevention among the participants, which may be researched in the future. Because the iliopsoas is the only muscle that connects the lumbar spine to the hip, shortening it causes anterior pelvic tilt and exerts undue strain on the lumbar spine and intervertebral disc, resulting in lower back pain (8).

Proper ergonomic setup, frequent rest, stretching, and strengthening exercises can all help to lessen physiological and psychological burdens on the body to varying degrees. Various therapeutic strategies, including posture education and muscle lengthening activities, have been used with varying degrees of evidence. This study was designed to screen for muscle flexibility, and a subsequent study that takes into account other characteristics may be conducted (8). So according to various previous studies, it is concluded that the neurodynamic mobilization of the femoral nerve improves flexibility and reduces tightness.

The intervention duration in this study was relatively brief, with no inclusion of long-term follow-up, and a limited sample size was employed. Future research endeavors could enhance the robustness of findings by conducting studies with larger sample sizes, incorporating extended follow-up periods, and implementing longer treatment durations. This was a heterogeneous group with both male and female population, future studies could be done taking up a homogenous sample with either male or female subjects separately.

Conclusion

The study indicates that neurodynamic mobilization of the femoral nerve leads to a reduction in tightness and an improvement in the flexibility of the iliopsoas in individuals engaged in desk work.

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preparation, A.P; writing—review and editing, A.P; visualization, A.P; supervision, R.G; project administration, A.P; funding acquisition, G.P. “All authors have read and agreed to the published version of the manuscript.”

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Informed Consent Statement: The authors declared that all the participants were informed of the research and Informed consent was taken from the study.

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