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"Effect Of Gluteus Medius Strengthening Exercises On Pain And Hip Range Of Motion In Subjects With Tight Piriformis In Healthy Sedentary Individuals: A Randomized Controm Trial".

[1]Vaishnavi Vinay Wale, [2]Dr. Shruti Gachhi,

[1]Physiotherapy Intern, [2]Assistant Professor

[1]College Of Physiotherapy,Wanless Hospital MMC,Miraj,India

[2]College Of Physiotherapy,Wanless Hospital MMC,Miraj,India

ABSTRACT

Background:

Piriformis muscle has a predominance type-I fibers which has a tendency to develop shortness or tightness when the muscle is abnormally stressed. Tightness leads to reduction in ROM, affects flexibility and causes discomfort and pain. A shortened piriformis can further produce compression of sciatic nerve.

A treatment program addressing hip abductors and extensors strengthening is needed in treatment of piriformis tightness.In the previous studies it was found that there is correlation between gluteus medius weakness and piriformis tightness.

Methodology:

Sedentary individuals with piriformis tightness{n=26}were included in this study. Gluteus medius strengthening exercises were given for 3 weeks. Pre and post range of motion and values were noted.

Result:

There was improvement in range of motion i.e abduction and external rotation ranges and reduction in

pain was also observed.

Conclusion :

It is concluded that gluteus medius strengthening exercises helps in improving range of motion and decreasing pain in subjects with piriformis tightness in healthy sedentary individuals.

Keywords:

RANGE OF MOTION(ROM),PIRIFORMIS MUSCLE TIGHTNESS(PMT),NUMERIC PAIN RATING SCALE(NPRS)FLEXION ABDUCTION INTERNAL ROTATION (NPRS)

INTRODUCTION

The flat muscle is located parallel to and below the gluteus medius's posterior border[10].The piriformis muscle provides postural stability when walking and standing by acting as an external rotator ,weak abductor and weak flexor of the hip.[1]

The prevalence of piriformis muscle tightness in sedentary individuals was found to be 79.5%, indicating that those who spend a lot of time sitting down and occasionally stand and walk are more likely to experience piriformis tightness .The adult population is more likely to experience piriformis muscle tightness, which can result in the development of piriformis syndrome and ultimately low back pain. Sedentary populations are more likely to experience piriformis tightness.[1]

The prevalence of piriformis muscle tightness in sedentary individuals was found to be 79.5%, indicating that those who spend a lot of time sitting down and occasionally stand and walk are more likely to experience piriformis tightness. The adult population is more likely to experience piriformis muscle tightness, which can result in the development of piriformis syndrome and ultimately low back pain. Sedentary populations are more likely to experience piriformis tightness.[1]

PMT, or piriformis muscle tightness, is linked to numerous hip, spine, and pelvic disorders. These may result in conditions including piriformis syndrome, sacral dysfunction, sacroiliitis, and low back discomfort, among others. People of any age, gender, or profession are susceptible to PMT. Research has indicated a correlation between PMT (5 to 36%) and low back pain sufferers.[11]

The sciatic nerve is irritated by the tense piriformis muscle, which results in piriformis syndrome and pain that radiates down the back of the leg (sciatica). Government officials, IT workers, contact center employees, and others are more likely to experience Piriformis discomfort while seated for extended periods of time. The piriformis muscle is used in all sitting positions, whether elevated or cross-legged, even though its function varies depending on the kind of sitting.[3]

When someone is diagnosed with PMT, they frequently describe four symptoms: buttock pain, pain that gets worse when you sit, soreness along the greater sciatic notch, and loss of range of motion when you raise your leg straight. [11]

Weakness in the hip abductors and extensor muscles causes the piriformis muscle to become overworked, which in turn causes the piriformis muscle to shorten and ultimately compress the sciatic nerve.Therefore, to lessen the strain on the piriformis, those muscles need to be strengthened. [7] People with low back pain who continue to sit have weak gluteus medius muscles. Of the 100 participants, 68% had a clinical diagnosis of tightness in the piriformis muscle, and 37% had weak gluteas medius.Thirteen percent of the participants had weakness in the gluteas medius and stiffness in the piriformis muscle.[2]Therefore, in order to lessen the load on the piriformis muscle, those muscles must be strengthened.

The anterior, middle, and posterior fibers of the gluteus medius muscle are the three separate segments of this muscle . Exercises that strengthen the gluteus medius are a crucial part of a lower limb problem therapeutic plan. Stretching enhances flexibility, lowers muscular soreness, avoids injury, and improves physical performance.[8]

A muscle kept in a protracted shortened condition is prone to weakening, and a shortened piriformis can cause compression of the sciatic nerve. Additionally, muscle shortening enhances deterioration by stretching the tendon, which causes weakness, inflammation, and degenerative changes. An alternative explanation proposes that hip musculature weakening may arise from persistent loading of the piriformis muscle due to over-lengthening and eccentric strain. (7)

Nicholson S claims that because people spend most of their time sitting and walking relatively little on a track, the gluteus muscles are the most neglected group of muscles in the entire body. Thus, this could result in the piriformis muscle activating synergistically and the gluteal muscle group becoming weaker. The piriformis muscular stiffness and hypertonicity may be the result of this over-activation.

The tiny size principle—which states that a fiber's conductivity increases with size—also contributes to overactivation of the piriformis muscle during posture maintenance. This explains the abundance of red fibers in postural muscles. Because they are smaller and simpler to activate, the neurons constantly send corrective signals and impulses to the postural muscles, allowing the body to maintain its posture.

Extended contraction of muscles can result in specific muscular strain, fatigue, tension, and other soft tissue injury. For sedentary people, piriformis muscle tightness is highly prevalent, which can be explained by these causes. (1)

IT workers who spend a lot of time sitting down are more likely to experience piriformis muscle tightness. This tightness in the muscles can put pressure on the sciatic nerve and irritate it, which can lead to low back pain, buttock pain, and radiating pain in the end. The piriformis muscle, a postural muscle that can become short from prolonged sitting and walking, can also become hypertonic, weak, and hyperactive (Mondal M et al, 2017).

Because of inactivity and strain, some muscles become weak and tense from sedentary behaviours. Chronic low back discomfort may result from weakening in the gluteus medius muscle. The person's everyday activities and productivity at work may be impacted by this low back pain. Our research focuses on evidence that indicates a higher risk of piriformis muscle tightness and gluteus medius weakness in the participants. These conditions can result in low back pain and other radicular symptoms in the lower extremities. It also impairs the person's ability to function on a daily basis and raises the risk of atrophy of the impacted muscles.

NEED FOR STUDY

- Previous studies found prevalence of piriformis tightness was 79.5 % in healthy sedentary individuals.
- Previous studies have shown gluteal muscle strengthening program was effective in decreasing pain and improvements in strength with significant improvement in lateral rotation, can be used to treat patients with piriformis syndrome. They have shown effectiveness of strengthening whole gluteal muscle group.
- Previous study shown correlation between gluteus medius weakness and piriformis tightness. So, there is need to study effect of gluteus medius muscle strengthening to release piriformis tightness.

AIM AND OBJECTIVES

AIM:

To find out effect of gluteus medius strengthening exercises on pain and hip range of motion in subjects with tight piriformis in healthy sedentary individuals

OBJECTIVES:

- To find out effect of gluteus medius strengthening exercises on pain using NPRS.
- To find out effect of gluteus medius strengthening exercises on hip range of motion using goniometer.
- To find out effect of and gluteus medius strengthening exercises on piriformis flexibility using FAIR test.

HYPOTHESIS

ALTERNATIVE HYPOTHESIS

There may be significant effect of gluteus medius strengthening exercises on pain and hip range of

motion in subjects with tight piriformis in healthy sedentary individuals.

NULL HYPOTHESIS

There may not be significant effect of gluteus medius strengthening exercises on pain and hip range of motion in subjects with tight piriformis in healthy sedentary individuals

REVIEW OF LITERATURE

1]Malika Mondal, Bibhuti Sarkar et.al [2017]

They conducted a research on frequency of Piriformis Tightness in inactive, healthy people. The piriformis stretch test and the seated piriformis stretch clinical test were used to measure how tight the piriformis muscle was. A total of 159 individuals (79.5%) had piriformis tightness. The third decade has the highest prevalence of tightness in the piriformis. The adult population is more likely to experience piriformis muscle tightness, which can result in the development of piriformis syndrome and ultimately low back pain. Sedentary populations are more likely to experience piriformis tightness. Thus, they came to the conclusion that sedentary people could benefit from preventive measures like good sitting posture, abductor muscle strengthening, and altered walking patterns, among others, to avoid piriformis tightness, which in turn prevents piriformis syndrome and episodes of low back pain. [1]

2]Dahiya, T., Verma, T., Fatima et.al [2022]

They looked at the incidence of Piriformis Tightness in Indian IT professionals and the relationship between it and gluteus medius weakness. The purpose of this research is to measure the prevalence of piriformis muscle tension and investigate any relationships with gluteus medius weakness.One hundred IT specialists were chosen at random. The piriformis stretch test is used to measure the piriformis's tightness, while the Glutes Medius is manually tested to gather data. The purpose of this research is to quantify the frequency of piriformis tightness and its relationship to the gluteus medius muscle. The study also shown a correlation between gluteus medius weakness and piriformis tightness. Thirteen participants were identified with both piriformis tightness and gluteus medius weakness, while 37 subjects exhibited gluteus medius weakness. Thus, it was determined that Indian IT workers have an increased chance of piriformis tightness and gluteus medius weakness, both of which can eventually result in low back pain.

3] Ruchika Zade, Sakshi P. Arora et.al [2022]

For piriformis tightness, they conducted a comparison research using two distinct stretching protocols: 30 seconds and 10 seconds. Two groups of twenty people were formed. A little over ten minutes before each group engaged in static stretching, each group was given an ice pack. Group A exercises for 30 seconds, while Group B exercises for 10 seconds. The Visual Analogue Scale (VAS), FAIR test, SLR, and range of motion assessment with a universal goniometer should be the patient's primary outcome measures. Given that a longer stretching duration has a greater effect on the release of piriformis stiffness and may enable the patient to execute compensatory movements, the patient's expected outcome may be that 30 seconds of stretching is preferable to 10 seconds.

4] Won-gyu Yoo[2014]

They looked into how certain strengthening workouts affected the gluteus medius subdivisions in a patient who had pain in the sacroiliac joint. Over the course of three weeks, students engaged in individual strengthening exercises for the gluteus medius subdivisions. VAS scores and pain-provocation tests were assessed both before and after the intervention. The client demonstrated no soreness in the following individual strengthening workouts for the gluteus medius subdivisions. The VAS score was

lower at 3/10 than it was at 7/10 at first. The patient's SI joint pain improved with specific strengthening workouts targeting the gluteus medius subdivisions.

5]Saeed, Quratulain; Malik et.al

They carried a research on how functional limitations and pain impact piriformis syndrome patients' quality of life. The piriformis must be stretched as part of the physiotherapy treatment procedures; however, the best order to stretch is only found by trial and error. This study aimed to establish the normative length of the piriformis in females at several reference points and to examine the impact of different stretching techniques on functional result in females with piriformis syndrome.This research, a randomized controlled experiment, was carried out from July to December 2015 at the Armed Forces Institute of Rehabilitation Medicine in Rawalpindi, Pakistan, in the physiotherapy department. Thirty patients with piriformis syndrome, aged between twenty and fifty, were participated in this study at the outpatient department. Two groups were randomly assigned to these patients. The external rotator sequence of self-stretching (ERS) was performed in one group, and in the Adductor series of passive stretching (APS) was used on the second group. Every group received therapy for a fortnight. The Functional Performance of Lower Extremity Scale (FPLES), the Numerical Pain Rating Scale (NPRS), and measurements of length at three reference positions were used to examine patients both before and after the intervention. In the statistical study, the independent T-test was employed. In terms of reduced pain scores on the NRPS, FPLES, and measured reference lengths at all three positions, both groups' results improved (p-value < 0.05). When the results of the pain score and the measured reference length at three distinct positions were examined, the adductor pattern of stretching was just as effective as the external rotator pattern (p-value> 0.05). Nonetheless, the external rotator stretching strategy outperformed the adductor stretching technique on the FPLES (p value < 0.05).The two sequences of piriformis stretching exercises that were tested show similar results in terms of a decrease in pain level and a clinically determined referenced length. Subsequent research will indicate which patient subgroups are most likely to benefit from a certain technique the most.

6] Nicholas A. Cooper, elsey M. Scavo et.al[2015]

Clinical observation indicates that patients with low back pain (LBP) frequently have hip abductor weakness, according to a study they conducted. This study aims to characterize and contrast the prevalence of hip abductor weakness in a matched sample without LBP and a clinical population with chronic non-specific LBP. Methods: A matched cohort of 75 control patients and 150 subjects with chronic nonspecific LBP were included. A standard physical examination of the hips and back was done. Manual muscle testing was used to measure the strength of the gluteus maximus, gluteus medius, and tensor fascia lata. Evaluation of the hip abductors' function was done in conjunction with a look for the Trendelenburg sign.

Palpation examination was used to try to replicate the subject's pain complaint in the hip, gluteal, and back regions. It was decided to examine the differences between the afflicted and unaffected sides of chronic low back pain patients and healthy controls using Friedman's test or Cochran's Q with post hoc comparisons adjusted for multiple comparisons. The Mann- Whitney U test was employed to examine variations in prevalence among various groups. We employed hierarchical linear regression to find the sample's LBP predictors.When compared to controls or the unaffected side, the gluteus medius is weaker in individuals with LBP (Friedman's test, $p<0.001$). Subjects with LBP exhibit a higher prevalence of the Trendelenburg sign compared to controls (Cochran's Q, $p<0.001$). When compared to controls, individuals with low back pain have more palpable tenderness throughout the gluteals, greater trochanter, and paraspinals (Cochran's Q, $p<0.001$). In this sample, LBP was predicted by male sex, low back regional soreness, and gluteus medius weakness, as shown by hierarchical linear regression with BMI as a covariate. In patients with persistent non-specific LBP, gluteal muscle soreness and gluteus medius weakening are frequent complaints. Subsequent research endeavors ought to confirm these conclusions using quantitative assessments and explore the impact of strengthening the gluteus medius in individuals with lower back pain.

7]Krishnendu Laha, Bibhuti Sarkar et.al[2018]

The effectiveness of strengthening the hip abductors and extensors on pain, strength, and lower extremity function in patients with Piriformis syndrome was studied. Thirty-three piriformis syndrome patients were split into two groups at random. In contrast to group B, which had five sessions per week for two weeks of solely neural mobilization and piriformis stretching, group A's subjects underwent ten sessions of hip abductor and extensor strengthening in addition to group B's neural mobilization. HHD tested the isometric strength of the hip abductor and extensor muscles, NPRS rated the degree of pain, and LEFS assessed the functional status. The study's findings demonstrated a statistically significant improvement in both groups' functional status and pain severity. However, only Group A demonstrated a statistically significant increase in hip abductor and extensor strength. The results of the study showed that when hip abductor and extensor strengthening exercises are paired with neural mobilization and piriformis stretching activities, hip abductor strength and functional status are improved even more

8]Raheela Kanwal, Javeria Khan et,al [2018]

In order to see how well stretching exercises (SE) and cross friction massage (CFM) reduced pain and disability in piriformis syndrome patients, a study was conducted. At Benazir Bhutto Hospital in Rawalpindi, a one-year randomized controlled experiment was carried out from June 2017 to June 2018. Data was gathered using a non-probability convenience sampling technique. The study comprised n=47 persons, aged 20–60, who had a mild to moderate level of disability on the Oswestry disability index (ODI) and scored +ve on the FAIR test. 47 people in total were split up into two groups: the SE group (n = 24) and the CFM group (n = 23). Age, gender, height, weight, BMI, and length of time spent sitting and standing were all used to gather demographic information. Every participant's Oswestry Disability Index (ODI) symptoms were assessed for signs of piriformis syndrome. The effects of the two rehabilitation methods were compared using an independent t-test, while variations within groups were examined using paired samples t-test analysis. The study participants' mean age was 37.62±8.97 for both groups. Significant differences were found in the total ODI of the CFM group and SE group (7.08±2.74 ver. 13.27, $p<0.001$) when comparing between-group variations. However, no statistically significant difference was observed between the two groups for any of the individual ODI items, such as lifting (1.13±0.91 ver. 1.58±0.97, p=0.10), standing (1.08±1.23 ver. 1.50±1.31, p=0.27), or sleeping (0.65±0.93 ver. 1.20±1.21, p=0.08). Conclusion: Compared to stretching exercises, cross friction massage is more helpful in lowering pain and enhancing functional skills in patients with piriformis syndrome.

9]Jason C. Tonley , Steven M. Yun et.al[2010]

They conducted research to explain a different method of treating piriformis syndrome that combined movement reeducation and a program to strengthen the hip muscles.Stretching and/or soft tissue massage to the piriformis muscle are common interventions for piriformis syndrome. This method is predicated on the idea that the compression on the sciatic nerve results from a shortening, or "spasm," of the piriformis.The 30-year-old male patient had been experiencing pain for two years in his right buttock and posterior thigh. Upon examination, the clinical findings included piriformis stretching and palpation of the symptoms being reproduced. Excessive hip adduction and internal rotation were found during movement analysis during a single-limb step-down, which mirrored his complaints. An evaluation of strength indicated that the external rotator and right hip abductor muscles were weak. The patient's only course of treatment consisted of movement reeducation and hip-strengthening exercises to address excessive hip adduction and internal rotation during functional tasks. The patient experienced 0/10 pain with all activities after the intervention. The original score of 65/80 on the Lower Extremity Functional Scale questionnaire was raised to 80/80. During a step-down test, lower extremity kinematics improved from 15.9° and 12.8° for peak hip adduction and internal rotation to 5.8° and 5.9°, respectively. This example emphasizes the requirement of functional movement analysis in the assessment of patients with piriformis syndrome and presents an alternate pathomechanics theory (overstretching as opposed to overshortening).

10]Hiya A. Kukadia, Ajay Malshikare et.al [2019]

In order to determine the prevalence of Piriformis tightness in young adult females, a comparative study was carried out. Additionally, the benefits of two definite ways of treatment—passive stretching (STR) and myofascial release (MFR)—on increasing the flexibility of Piriformis muscles were compared. Procedure: Thirty participants were recruited based on inclusion and exclusion criteria after their tightness was evaluated. People were divided into A and B groups. Range of Motion was used to take pre- and post-assessments. Findings: Both groups' post-intervention Piriformis muscle flexibility was significantly higher than it was before the intervention.

11]ATTA MUHAMMAD1 , MUHAMMAD RIZWAN RANA et.al [2022]

They carried out a study to find out how common piriformis muscle stiffness is among allied health students and how it relates to age, gender, and academic year. There was a cross-sectional study carried out. Open Epi v3.01 was used to calculate a sample size of 259. This four-month study involved allied health students from programs in physical therapy, occupational therapy, and prosthetics and orthotics. Following the acquisition of informed consent, information was gathered via a self-created survey. Using the FAIR test, piriformis muscle tension and symptom recurrence were identified. The participants' average age was 21.94±1.81 years. 79.9% of the study population was female. A sizable portion (85.3%) came from the program in physical therapy. Sitting with crossed legs was the most prevalent position (48.3%). Forty-seven percent of the population tested positive for FAIR. A significant age-group connection was found using the FAIR test (p=0.036).Prolonged sitting positions are known to cause piriformis muscle tension. Additionally, there is a high correlation between piriformis tightness and age; however, there is no correlation with gender or study year.

13]Mario A. DiMattia, Ann L. Livengood, et.al[2005]

Two tests that have not been previously established as measures of hip-abduction strength are the Trendelenburg and single-leg squat (SLS). to ascertain the criteria validity of a clinical observation analysis approach to assess an SLS against 2-dimensional kinematic analysis and to connect isometric hip-abduction strength to frontal-plane hip motion during an SLS. Single-measurement design with concurrent validity. Location: Laboratory for Biodynamic Research. 50 participants were present who were not hurt.Strength in the hip abduction and data on the kinematics of the hips and knees during an SLS and Trendelenburg test.Hip-abduction strength and hip-adduction angle showed a weak but positive connection in both the Trendelenburg (r =.22, P =.13) and SLS (r =.21, P =.14) tests. When compared to the kinematic data, the observation analysis approach showed a low sensitivity of.23 and a high specificity of.86. The Trendelenburg and SLS test has little utility in assessing hip-abductor strength in a physically active, healthy population. Further objective examination is necessary to determine the cause of visible impairments during SLS.

14]Helen P. French , Mark Dunleavy, et,al [2010]

They studied gluteus medius strengthening exercises (GMed), which are often prescribed in functional situations and are a key component of lower limb care strategies for conditions like osteoarthritis and patello-femoral syndrome. Muscle activation can be measured using electromyography (EMG) to determine how much muscle is recruited during activity. to examine the data that is currently available on the level of GMed activation as detected by EMG during therapeutic exercise. An organized analysis of research that examined the GMed EMG magnitude while performing various therapeutic exercises was conducted. GMed's amplitude levels were expressed as a percentage of the highest possible voluntary isometric contraction.There were fifteen studies total. Three of these research looked into people with knee or hip disease, whereas the majority of these were done on asymptomatic volunteers. Numerous exercises in both weightbearing (WB) and nonweightbearing (NWB) positions were examined. EMG activity was generally higher in WB postures, albeit there was variance throughout trials. A lot of the workouts fell short of what was thought to be required for strength increases. Although there was some inconsistency in the reporting of the study's technical components, the methodological quality was generally excellent. Numerous studies failed to recognize the various limitations of

electromyography (EMG) in assessing muscle activation during therapeutic exercise.0Although there were some differences in the results between the studies, which could be attributable to issues with EMG recording and quantification as well as exercise execution, the results do provide some insight into GMed recruitment during exercise. Results extrapolated to symptomatic populations in a medical context

15]DIANNE B. CHERRY et.al,[1980]

Passive stretching is a technique that is commonly used to treat muscle contractures; however, because it can activate the stretch reflex and has little carry-over, it may not be as effective as other modes. This was discovered during a review of physical therapy alternatives for reducing muscle contracture. There are four methods for treating muscular contracture that are explained: 1) the weak opponent is activated or strengthened; 2) the contracted muscle is locally inhibited; 3) hypertonus is generally inhibited; and 4) passive lengthening occurs. Techniques are explained with specific examples, justifications, and recommendations for use.

16]Samraiz Mughal,Mansoor Ahmad et.al[2020]

Adults and older adults, especially those with sedentary lifestyles, are more susceptible to low back pain and piriformis tightness. These conditions can cause localized or radiating discomfort over the piriformis muscle region. The situation could be brought on by extended sitting, bad posture, or unsupportive chair ergonomics, but stuffing a bulky wallet into your back pocket makes it worse. symptoms that are further classified as fatty wallet syndrome or wallet neuritis. Our culture of shoving your wallet in your back pocket while being unaware of its negative effects is spreading, and a smaller percentage of people are trying to address this issue head-on. Convenient sampling method of study design: 190 respondents from a cross-sectional study of bankers in Faisalabad, the city, have been recruited for a closer look. The Piriformis stretch test was carried out as a means of verifying the results before ruling out any associated symptoms or signs. An analysis of the frequency distribution of the corresponding group of people revealed that approximately 65.4% of them received positive results from the piriformis stretch test, supporting the notion that piriformis tightness predominated among 17]HAROON RAZA , HAFIZ RANA MUHAMMAD ARSLAN et.al[2021]
to evaluate the impact of strengthening the gluteal muscles on piriformis syndrome. Two groups were formed out of them. The control group underwent traditional isometrics, ultrasonography, and piriformis stretching. The experimental group had gluteal strengthening exercises, ultrasound therapy, and piriformis stretching. The Visual Analogue Scale (VAS) and Manual Muscle Testing (MMT) were used to measure the baseline parameters. For four weeks, patients received 40 minutes of treatment three times a week. Both groups experienced an improvement in range of motion and a decrease in pain intensity. Since the piriformis is a lateral rotator of the hip joint, there was a notable improvement in the experimental group's hip lateral rotation. This suggests that a gluteal strengthening program is important for expanding the range of motion (ROM) of the joint. Comparatively speaking, the experimental group's gluteal muscles showed a considerable improvement in MMT grade.The experimental group's increases in strength and pain reduction, along with a notable improvement in lateral rotation, indicate that patients with piriformis syndrome may benefit from a gluteal strengthening program.

18]Sumeet Roy & Nirali Solanki, Shivam Acharya et.al[2022]

Piriformis tightness is a rare condition in modern society that interferes with a person's everyday activities and impairs their ability to operate both physically and socially. Because there are no symptoms, it is exceedingly difficult to diagnose the tightness in its early stages. However, this reduces ROM and has an impact on flexibility. If not identified sooner, Pirifromis Syndrome may worsen. This study is useful for both diagnosing Pirifromis stiffness and for applying Static Stretching and MET to release the tensed tissues. Participants will be chosen from Ahmedabad's various hospitals according to the inclusion criteria. LEFS will be utilized to ascertain the subjects' current state. After then, two groups of participants will be formed using the convenience sampling technique. Group A, which consists of fifteen individuals, will get MET for four weeks at a rate of seven sessions per week for ten to fifteen

minutes each. For four weeks, Group B, consisting of fifteen individuals, will receive static stretching seven times a week for ten to fifteen minutes per session.When Group A and Group B's mean values on ROM and LEFS were compared, Group A's mean values differed significantly, at $P < 0.001$.The study shows that for those with tight piriformis muscles, Muscle Energy Technique works better than Static Stretching.

19]Laura Presswood, John Cronin et.al [2008]

A COMMON DEFICIT SEEN BY STRENGTH AND CONDITIONING PRACTITIONERS AND REHABILITATION SPECIALISTS IS THE WEAKNESS OF THE GLUTEI MUSCLES, ESPECIALLY THE GLUTEUS MEDIUS (GM). A FEWER EXTREMITY INJURIES MAY OCCUR AND ATHLETIC PERFORMANCE MAY BE DECREASED BY GLUTEAL WEAKNESS. The anatomy and function of the GM muscle are discussed in this article, along with a review of the literature currently available on GM conditioning and a recommendation for an exercise model based on current strengthening guidelines. This article's main goal is to give strength and conditioning specialists a template or guidance for how to treat athletes with GM-related injuries during their recovery process in order to enhance their sports performance. In order to accomplish this, we (a) outline the fundamental structure and operation of the GM, (b) discuss the causes of GM weakness and the injuries that may result from it, (c) outline the methods for evaluating GM function, (d) provide a list of potential strengthening exercises, and (e) examine the literature for experimental studies that have been conducted in this field. We then provide a methodology that incorporates a methodical and progressive approach to GM rehabilitation and strengthening using this information and internationally recognized conditioning practice recommendations.

20]Gopal Nambi Subash Chandra Bose1 and Gopal Dusad et.al[2018]

They studied Piriformis syndrome (PS), a neuromuscular disorder that can also affect the thigh and lower back and is characterized by pain in the buttocks and hips. In order to relieve pain, the Muscle Energy Method combines two methods: post-isometric relaxation (PIR) and reciprocal inhibition (RI). Therefore, the study's objective was to evaluate the effects of post-isometric relaxation and reciprocal inhibition in patients with Piriformis syndrome. Using a random assignment technique, 64 participants were split up into 3 groups. Subjects in Groups A and B ($n = 15$) underwent reciprocal inhibition, post-isometric relaxation, and conventional intervention alone, while Group C ($n = 15$) did not receive any of these treatments. Over a two-week period, the treatment consists of 12 sessions. At the beginning and end of the 12th therapy session, measures of pain intensity, hip range of motion, and functional disability were taken. Findings: At the conclusion of the twelfth session, a significant difference ($p = 0.000$) was found in the intergroup comparison of pain intensity, hip abduction, internal rotation, and functional disability score.

21]Pradip B, Sudhir B et.al [2018]

They carried out a study on how leading a sedentary lifestyle can cause a number of issues, such as muscular tightness, reduced joint range of motion, and decreased flexibility, which can interfere with an individual's everyday tasks. Individuals who work in jobs that require them to sit for extended periods of time, such as desk workers or computer experts, are more likely to experience adaptive alterations that can shorten their hip muscles. Computer office workers frequently report feeling stressed out at work and experiencing a variety of physical pains. The purpose of this study was to assess and screen male middle-aged desk workers for hip joint hypertightness.The inclusion and exclusion criteria were followed in the selection of 120 IT professionals. Written consent was obtained after the operation was described. Three hip muscles were assessed for tightness: the hamstrings, iliopsoas, and piriformis. Standard procedures for evaluating muscle length were used. Sixty-six percent of the 120 participants had tight hamstrings, eighty-three percent had tight iliopsoas, and 38 percent had tight piriformis. Therefore, it was determined that most desk job workers may experience tightness in these muscles at some point in their lives, which increases their risk of developing low back pain or other back or hip complaints.

MATERIALS AND METHODOLOGY

METHODOLOGY:

- **Type of Study:** Interventional study
- **Study Design:** Experimental study
- **Study Duration:** 6 months
- **Sample Size:** 26
- **Sampling Method:** Simple random sampling.
- **Study setting :** Wanless Hospital, Miraj.

M ATERIALS:

1]Universal goniometer 2]Plinth

3]Hot pack 4]Low stool

FIGURE:1

FIGURE:2

FIGURE:3

FIGURE:4

INCLUSION AND EXCLUSION CRITERIA

INCLUSION CRITERIA

1]Subjects having prolonged sitting work (About 2 hours of an 8-hour work day) from last 1 year. 2]Both female and Male.

3]Age:25-55 years.

4]Positive test for FAIR test=for piriformis tightness.

5]Positive single leg squat test=for gluteus medius weakness [12]

6]Pain- In buttocks, pain which is increased with sitting, tenderness along greater sciatic notch.

EXCLUSION CRITERIA

1] H/O fracture of pelvis, femur, Sacrum (less than 3 months) 2]Subjects with skin infections.
3]Any cardiopulmonary condition, recent cardiac surgery, recent abdominal surgery. 4]Muscle weakness/tightness due to any neurological condition.
5]Hip and sacroiliac osteoarthritis 6]Spinal deformities.
7]Spinal conditions such as spondylosis, spondylolisthesis, spondylolysis. 8]Co-morbid conditions such as diabetes and hypertension.

PROCEDURE

Ethical Committee Clearance

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Assessment for Piriformis tightness using Fair test, ROM, NPRS

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Screening according to Inclusion and Exclusion criteria

↓

Selection of participants

↓

Explaining the Intervention to the individual and obtaining the written consent from the individuals

↓

Participants will be randomly divided into two groups

↓	↓
Group A	Group B
[Control group]	[Experimental Group]
↓	↓
Pre-Intervention assessment using FAIR test, ROM, NPRS	
↓	↓
Hot pack +Piriformis Stretching	Hot pack +Piriformis stretching+ gluteus
Medius strengthening exercises	
↓	↓

Post-treatment outcome measures- numerical pain rating scale (NPRS) and Range of motion [ROM].

PROCEDURE

PRE -TREATMENT ASSESSMENT

FAIR TEST(FLEXION ADDUCTION INTERNAL ROTATION):

Simultaneous downward pressure at the flexed knee and passive superolateral movement of the shin, withboth acetabula oriented vertically, maximizes adduction and internal rotation at the flexed thigh. Any discomfort or pain suggests that FAIR test is positive

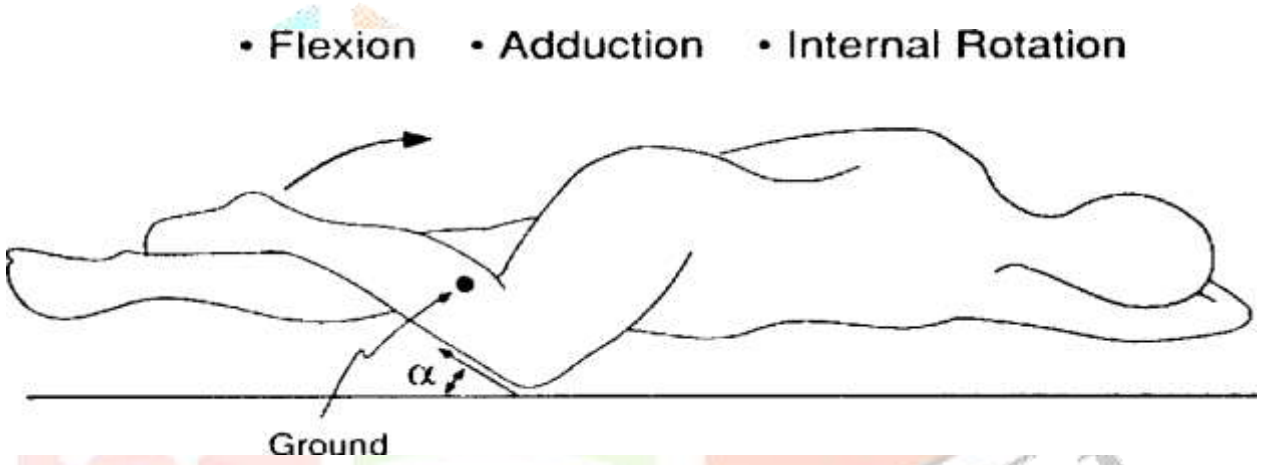


Figure:5

SINGLE LEG SQUAT TEST FOR GLUTEUS MEDIUS:

The patients stands on the limb being evaluated, with the other leg lifted off the ground so that the hip is flexed to approximately 45° and the knee to approxi- mately 90°. The patient's shoulders are forward flexed to 90°, with the elbows in full extension and hands clasped together in front. The patient is instructed to squat down to approximately 60° and return to the start position in less than 6 s. When test- ing higher level patients, a larger knee angle can be used to increase difficulty. A guide bar can be placed behind the athlete's buttocks to indicate when the proper knee flexion angle is reached.

TABlE 1. SCORinG CRiTERiA in ASSESSinG A SinGlE-LEG SqUAT

Grade	Hip and Knee Criteria
Excellent	Hip flexion < 65°, hip abduction/ adduction < 10°, knee valgus/varus < 10°
Good	Any 2 of the above criteria are met.
Fair	Any 1 of the above criteria is met.
Poor	None of the criteria are met or the athlete loses balance and falls.

Figure:6

TREATMENT:

They were divided into two groups.

Control group-Hot pack, piriformis stretching.

Experimental group-Hot pack, stretching and gluteus medius strengthening exercise.

For experimental group individual strengthening exercises will be given for the subdivisions of gluteus medius.

1]Anterior gluteus medius 2]middle gluteus

3]left gluteus medius 4]posterior gluteus medius

Hot pack:

For 15 minutes.

Piriformis stretching:

The leg being evaluated is bent at the hip and knee, with the foot lying lateral to the contralateral knee. Hip flexion should be kept to a maximum of 60 degrees.

30 seconds, then repeated 5 times in one session. This method should be repeated twice a day

Figure:7

Gluteus medius strengthening exercises:

For all exercises, three sets of 30 repetitions per day were performed for 3 weeks.

1) Anterior gluteus medius- hip abduction exercise with knee extension in side lying.

Figure:8

2) Middle gluteus-wall press exercise:

Figure:9

3) Left gluteus medius-pushing the left knee, hip, and ankle at 90degree flexion against a wall and maintaining the contraction for 5 sec.

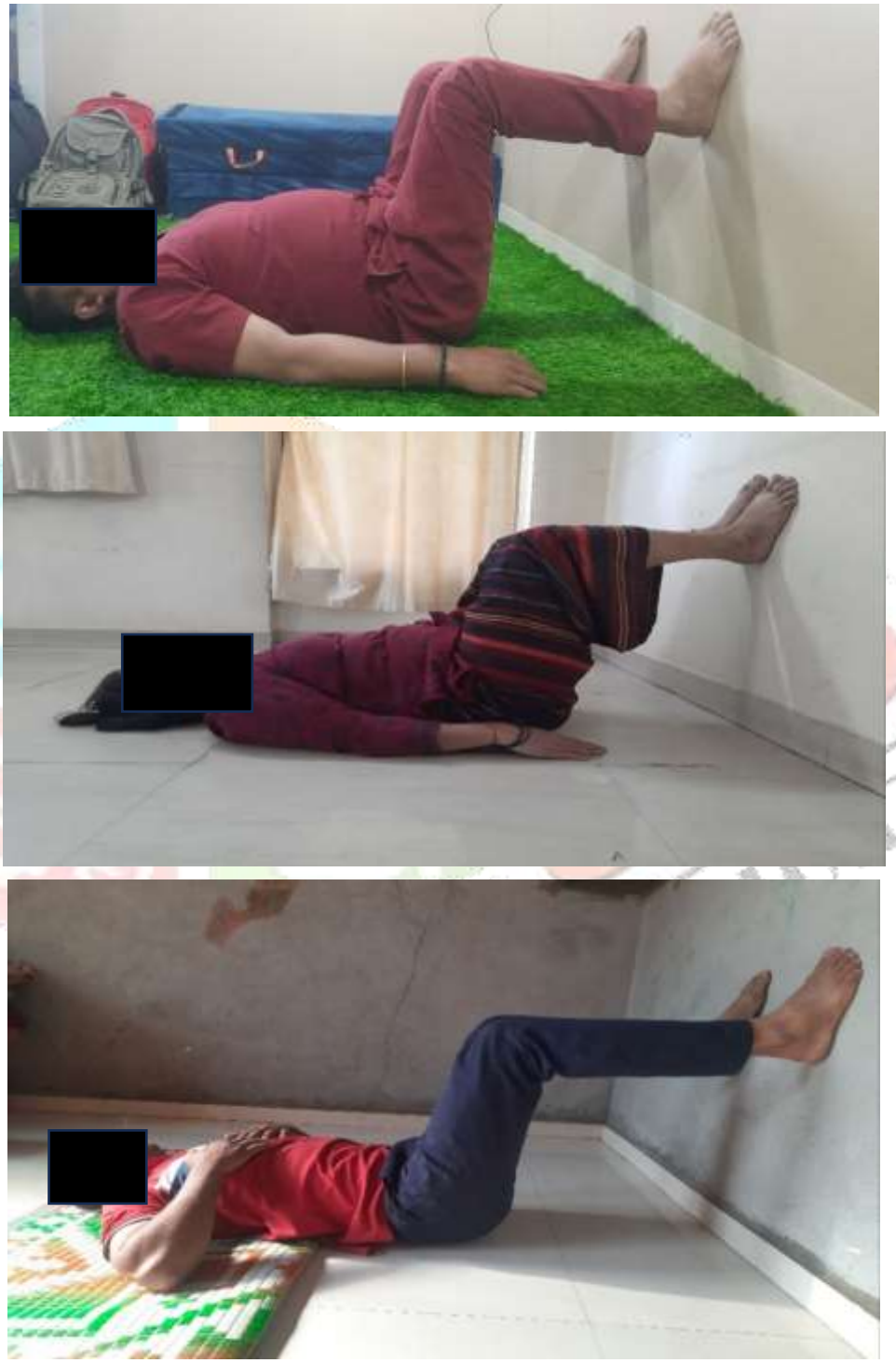


Figure:10

4) posterior gluteus medius-pelvic drop exercise-

Figure:11

STATISTICAL ANALYSIS

Data analysis was done using t test between the groups and paired t test among the groups.

Sample Standard deviation –

$$s = \sqrt{\frac{\sum(X - \bar{x})^2}{n - 1}}$$

X – The Value in the data distribution
$\bar{x}$ – The Sample Mean
n - Total Number of Observations

Paired T test formula-

$$t = \frac{\Sigma d}{\sqrt{\frac{n(\Sigma d^2) - (\Sigma d)^2}{n - 1}}}$$

Normality test using Shapiro-Wilk

RESULTS

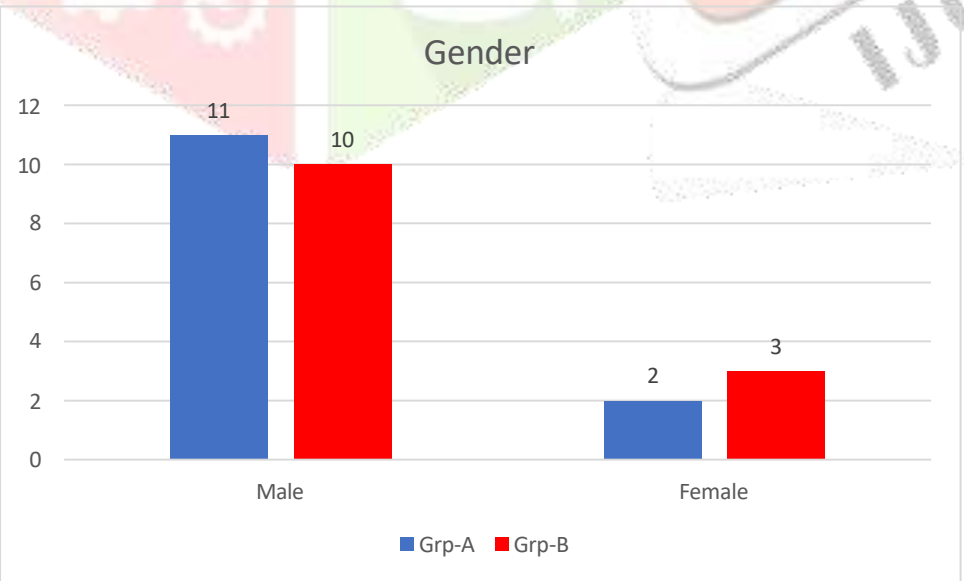
Data set is not normally distributed as all the variables have not indicated p-value more than 5% in the observation. The researcher shall use non-parametric test for data analysis purpose in the following sections.

TABLE 1: Normality test using Shapiro-Wilk

Variable	Time frame	Group A		Group B	
		z-value	p-value	z-value	p-value
OM External Rotation	Pre	0.761	0.002	0.815	0.010
	Post	0.828	0.015	0.818	0.011
ROM Abduction	Pre	0.735	0.001	0.859	0.037
	Post	0.834	0.018	0.893	0.106
NPRS	Pre	0.862	0.041	0.883	0.078
	Post	0.646	0.001	0.812	0.010

Table 2:Total number of males and females.

Particular		Group		Total
		Grp-A	Grp-B	
Gender	Male	11	10	21
	Female	2	3	5
Total		13	13	26



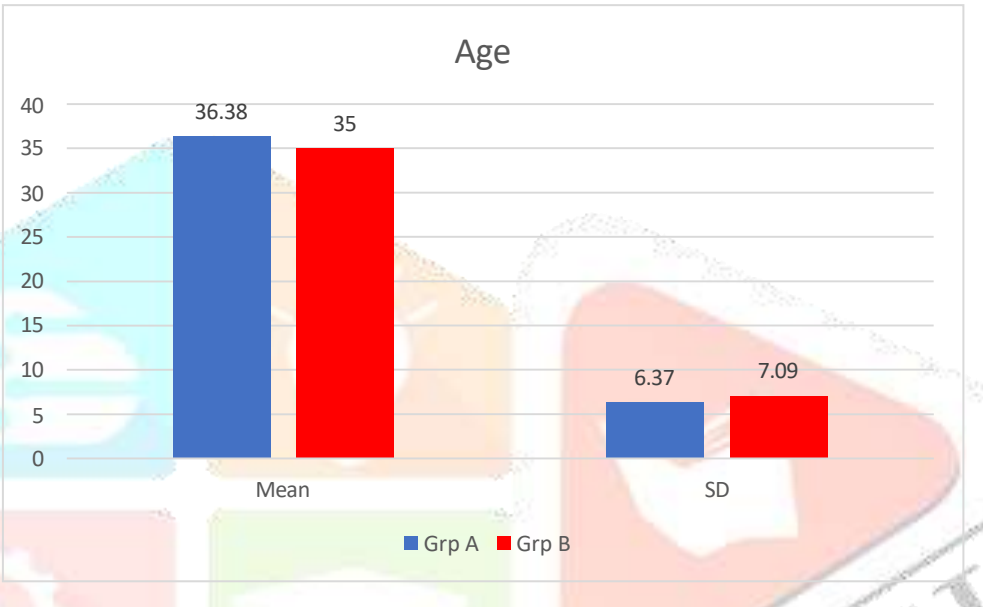
Graph 1: **Total number of males and females.**

Independent sample test

Comparison of Groups with Mann Whitney test

Table 3: Comparison of Groups with Mann Whitney test

Variable	Group	Mean	SD	z-value	p-value
Age	Grp A	36.38	6.37	0.699	0.485
	Grp B	35.00	7.09		



Graph 2: Comparison of Groups with Mann Whitney test

Within group Pre and post test

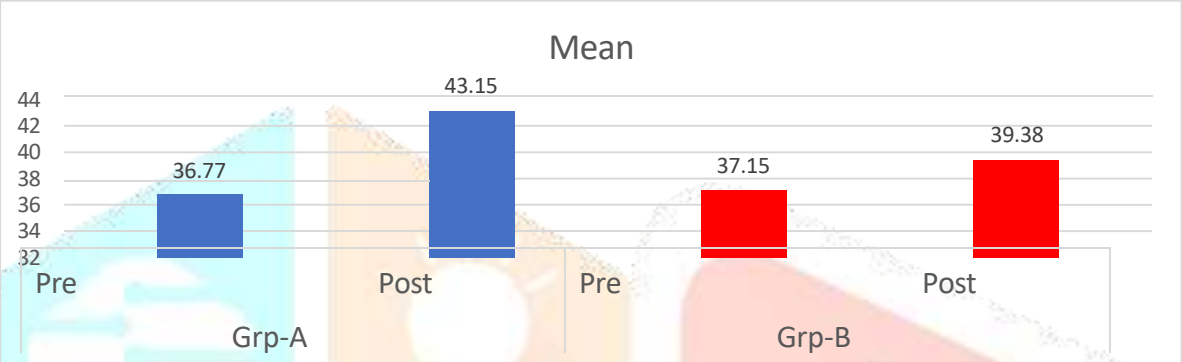
Comparison of pre-test and post-test scores of ROM External Rotation in two Groups by Wilcoxon Test

Table 4: Comparison of pre-test and post-test scores of ROM External Rotation in two Groups

The mean value in group A indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 3.73 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

The mean value in group B indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the limited consistency with post treatment value which is more than pre value. The effect size or Cohen's D indicates 3.07 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	36.77	2.09	6.38	1.71	3.73	3.200	0.001*
	Post	43.15	1.91					
Grp-B	Pre	37.15	2.79	2.231	0.725	3.07	3.304	0.001*
	Post	39.38	2.87					



Graph3: Mean

Within group Pre and post test

Comparison of pre-test and post-test scores of ROM Abduction in two Groups by Wilcoxon Test

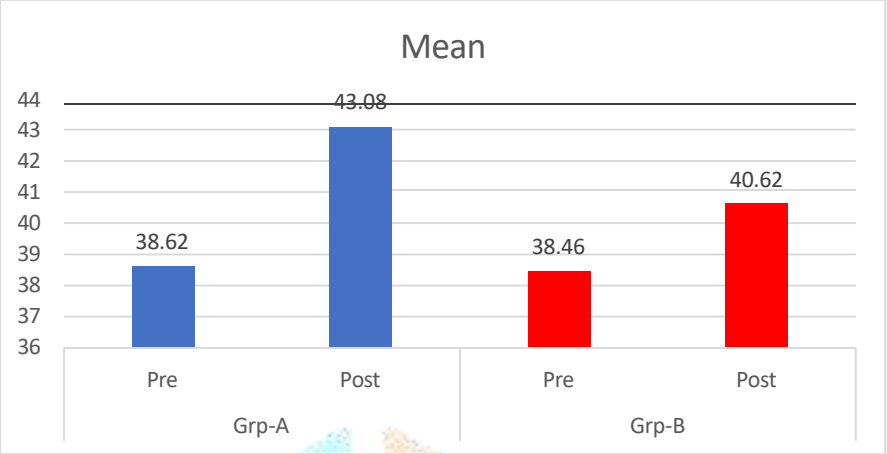
Table 5: Comparison of pre-test and post-test scores of ROM Abduction in two Groups

The mean value in group A indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 3.21 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

The mean value in group B indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the limited consistency with post treatment value which is more than pre value. The effect size or Cohen's D indicates 2.69 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	38.62	1.85					

	Post	43.08	1.66	4.46	1.39	3.21	3.210	0.001*
Grp-B	Pre	38.46	2.79	2.15	0.80	2.69	3.267	0.001*
	Post	40.62	2.87					



Graph 4: Comparison of pre-test and post-test scores of ROM Abduction in two Groups

Within group Pre and post test

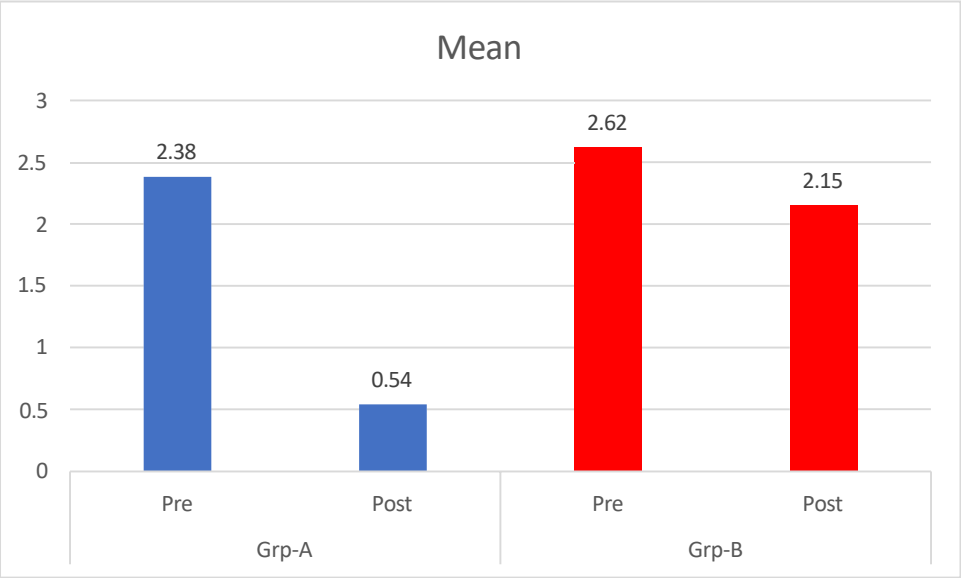
Comparison of pre-test and post-test scores of NPRS in two Groups by Wilcoxon Test

Table 6: Comparison of pre-test and post-test scores of NPRS in two Groups

The mean value in group A indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 1.87 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

The mean value in group B indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 0.69 value which is assumed to be medium in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.034 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Grp-A	Pre	2.38	0.96	1.85	0.99	1.87	3.025	0.001*
	Post	0.54	0.52					
Grp-B	Pre	2.62	0.96	0.462	0.660	0.69	2.121	0.034*
	Post	2.15	0.80					



Graph 5: Comparison of pre-test and post-test scores of NPRS in two Groups Between groups independent test for Group Statistics using independent samples t test

Table 7: Between groups independent test for Group Statistics

From the above table it is observed that between groups analysis is not significant for ROM External Rotation pre time frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups

From the above table it is observed that between groups analysis is significant for ROM External Rotation post time frame at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups

From the above table it is observed that between groups analysis is not significant for ROM Abduction pre time frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups

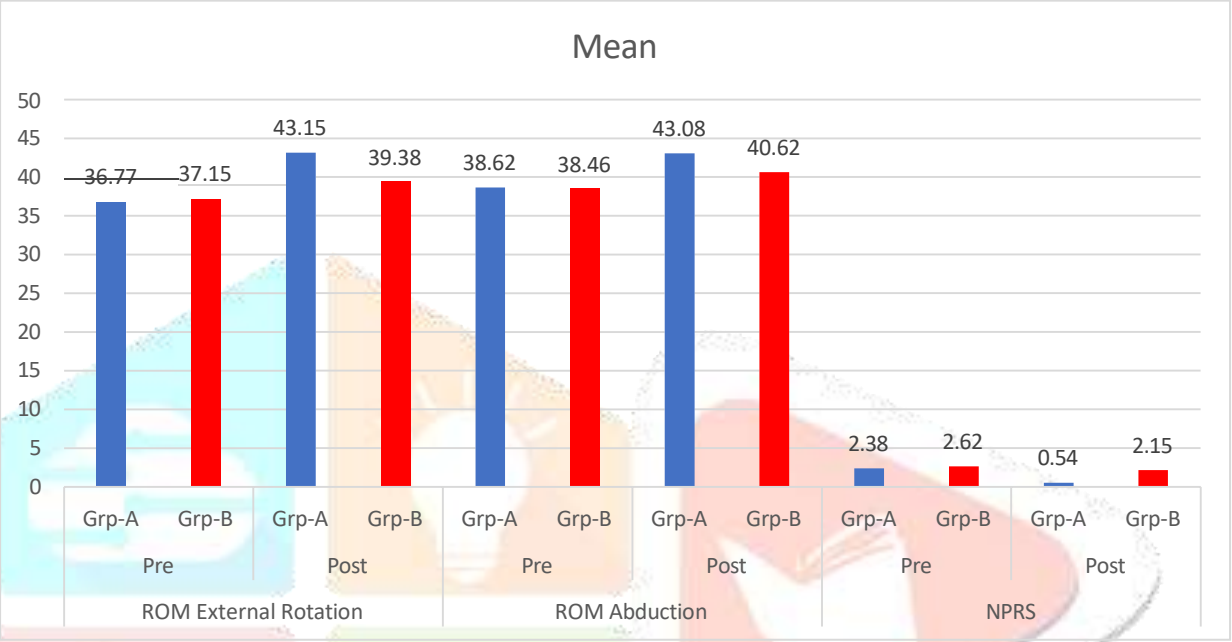
From the above table it is observed that between groups analysis is significant for ROM Abduction post time frame at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups

From the above table it is observed that between groups analysis is not significant for NPRS pre time frame at 5% level significance as the p-value is more than 5%. It shows non- significant differences between the groups

From the above table it is observed that between groups analysis is significant for NPRS post time frame at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups

Variable	Time	Group	Mean	SD	t-value	p-value
OM External Rotation	Pre	Grp-A	36.77	2.09	0.704	0.481
		Grp-B	37.15	2.79		
	Post	Grp-A	43.15	1.91	3.351	0.001*
		Grp-B	39.38	2.87		
ROM Abduction	Pre	Grp-A	38.62	1.85	0.054	0.957
		Grp-B	38.46	2.79		
		Grp-A	43.08	1.66		

	Post	Grp-B	40.62	2.87	2.312	0.021*
NPRS	Pre	Grp-A	2.38	0.96	0.601	0.548
		Grp-B	2.62	0.96		
	Post	Grp-A	0.54	0.52	3.961	0.001*
		Grp-B	2.15	0.80		



Graph 6: Between groups independent test for Group Statistics

From above graph it is observed that between group analysis is significant for range of motion i.e. Abduction and external rotation and for NPRS.

DISCUSSION

The purpose of this study was to study the effect of gluteus medius strengthening exercises on pain hip range of motion in subjects with piriformis tightness in healthy sedentary individuals and finding the effect of each intervention and comparing its effects to fulfil the aim of the study .

Total 26 patients with piriformis tightness were divided into two groups ie. Experimental group(group A) and other control group (group B) 13 in each group.All patients were treated with conventional interventions added with gluteus medius strengthening exercises in group A.Outcome measures included NPRS,hip abduction and external rotation by goniometry.

All groups were homogenous in their demographic details as well as in baseline outcome measures. For

finding inter- and intragroup comparison of scores of outcome measures one way t-test were used respectively. The results show significant improvement in each group. There was a tendency for both the experimental groups (Group A & B) to perform better than control group in almost all the outcomes.

Results show that all the interventions were effective in reducing pain, improving ROM in patients. Multiple comparisons for mean of difference of treatment session was done for all the outcome measures.

Sedentary people typically complain of low back discomfort caused by muscle imbalance since their jobs need them to sit for long periods of time with some perform work activities, you will need to walk and stand on occasion. Sedentary persons had a 79.5 percent prevalence of piriformis muscle tension.

Hot pack usually gets absorbed more in tissues with high fluid content especially muscle. Piriformis muscle being a deep seated muscle must have got adequate heating effects, which could have reduced inflammatory process and subsequently has reduced spasm and increased flexibility of this muscle.

Stretching is an important part of any workout or physical activity. Stretching is also used by rehabilitation professionals to help with mobility and functional recovery. There are a variety of stretching strategies (3 second, 5 second, 7 second, 10 second) and no consensus on what would be the most effective, especially for piriformis tightness stretching in the short term.

Stretching improves physical performance ability, prevents injury, reduces muscle pain, and increases flexibility.10,

In the previous study by Zade R, Arora SP, Phansopkar P, Deshmukh M. A comparative study based on two different stretching protocol of 30 second vs 10 second for piriformis tightness. The experiment will be a randomized trial. A total of 20 persons would be chosen for the study based on the inclusion or exclusion criteria from AVBRH & RNPC, Sawangi Meghe. The study will last six months. Twenty participants were divided into two groups. All groups received an ice pack approximately 10 minutes prior to stretching, and all groups received static stretching. Stretching is done for 30 seconds in group A and 10 seconds in group B. The key outcome measurements for the patient should be the Visual Analogue Scale (VAS), range of motion evaluation using a universal goniometer, FAIR test, and SLR. The patient's predicted outcome may be that 30 seconds with stretching is more beneficial than 10 seconds of stretching since the longer stretching period has a bigger impact on the release of piriformis stiffness and the patient may be capable of performing compensatory movements as a result. This research gives the patient a recovery plan that will help him reduce discomfort, improve strength and range of motion, and return to normal activities.

Gluteus medius strengthening exercise are both effective in improving hip range of motion and decreasing pain.

Joseph M. McBeth [14] (2012) conducted a study using electromyography (EMG) have shown that the gluteus medius is most active during a single-plane, sidelying hip-abduction (ABD) exercise as compared with a variety of other exercises. Many therapists suggest that the best exercise for the gluteus medius is side-lying abduction. However, previous functional studies have found subdivisions of the gluteus medius.

O'Sullivan et al.6) showed that activation of the gluteus medius was highest in the wall press exercise, and the posterior fiber showed the strongest activation during the pelvic drop, wall press, and wall squat exercises in healthy subjects.

CONCLUSION

This study highlights the effect of gluteus medius strengthening exercises on pain and hip range of motion in subjects with piriformis tightness in healthy sedentary individuals. This study concludes that gluteus muscle strengthening exercises are effective in improving hip range of motion and reduce pain thus improving piriformis flexibility.

In between group analysis Group A=Experimental group showed statistically significant improvement on compared with Group B. Overall analysis of the data demonstrated that hot pack along with piriformis stretching and gluteus medius strengthening exercises have significant effect on improving hip range of motion and reducing pain when compared with hot pack and piriformis stretching alone.

LIMITATIONS AND SUGGESTIONS

1) More number of female participants may be included in this study.
2) Sample size may be large.

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ANNEXURE I ETHICAL CLEARANCE

MIRAJ MEDICAL CENTRE'S
COLLEGE OF PHYSIOTHERAPY
MINORITY INSTITUTION (Estb. 2015)
WANLESS HOSPITAL (Estb. 1894)
MIRAJ - 416 410. MAHARASHTRA STATE, INDIA.
Over 125 years of Healing and Hope
(Affiliated to Maharashtra University of Health Sciences, Nashik)

Ph. (College) : 7447794777
: 7447494777
Director Off. : 0233 - 2222548
Admission Off. : 0233 - 2223291 to 95

Website : www.whmmccopt.in
E-mail : cop.principalwanless@gmail.com
copwanlesshospital@gmail.com

MMC/COP/WH/Ethical clearance / 1962/2023 Date : 06/04/2023

To
Miss. Vaishnavi Wale/Dr. Shruti Gachhi
College of Physiotherapy, Wanless Hospital, Miraj

Ref: Your project no. 147 entitled "EFFECT OF GLUTEUS MEDIUS STRENGHTENING EXERCISES ON PAIN AND HIP RANGE OF MOTION IN SUBJECTS WITH TIGHT PIRIFORMIS IN HEALTHY SEDENTARY INDIVIDUALS: A RANDOMIZED CONTROL TRIAL" received by IEC on 6th April 2023.

Sub : Regarding submission of project to IEC

Dear, Vaishnavi Wale / Dr. Shruti Gachhi
The meeting of institutional ethics committee (IEC) was held on 03/04/2023 at 2.00pm in the incubation center with Dr. Prabha S. Quaraishi as a chairperson. 8 members attended the meeting held on 3rd April 2023. The list of members who attended the meeting is as follows

SR. NO.	NAME	DESIGNATION
1.	Dr. Prabha S. Quaraishi	Director and Program Co-ordinator
2.	Dr. Fredrick John	Principal, College of Physiotherapy
3.	Dr. Vrushali Bhore	Dept. of Neurophysiotherapy
4.	Dr. Akshay Chaugule	Dept. of Musculoskeletal Physiotherapy
5.	Dr. Mrunali Patel	Dept. of Cardiovascular and Respiratory Physiotherapy
6.	Dr. Shruti Gacchi	Dept. of Community Physiotherapy
7.	Dr. Pawan Joshi	Dept. of Kinesiotherapy and Physical diagnosis
8.	Dr. Shweta Pimpale	Dept. of Electrotherapy and Electro diagnosis

College of Physiotherapy MIRAJ Wanless Hospital

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COLLEGE OF PHYSIOTHERAPY
MINORITY INSTITUTION (Estb. 2015)
WANLESS HOSPITAL (Estb. 1894)
MIRAJ - 416 410. MAHARASHTRA STATE, INDIA.
Over 125 years of Healing and Hope
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Ph. (College) : 7447794777
: 7447494777
Director Off. : 0233 - 2222548
Admission Off. : 0233 - 2223291 to 95

Website : www.whmmccopt.in
E-mail : cop.principalwanless@gmail.com
copwanlesshospital@gmail.com

The institutional ethics committee reviewed the above mentioned clinical study & approved the following documents submitted for this clinical study at the meeting.

1. Suggested change in title
2. Correction in the sample size
3. Study setting

The IEC hereby approves the proposal "EFFECT OF GLUTEUS MEDIUS STRENGHTENING EXERCISES ON PAIN AND HIP RANGE OF MOTION IN SUBJECTS WITH TIGHT PIRIFORMIS IN HEALTHY SEDENTARY INDIVIDUALS: A RANDOMIZED CONTROL TRIAL" received by IEC on 6th April 2023.

It is understood that the study will be conducted under your direction in total of 26 research participants at Sangli,Miraj as per the submitted protocol. This approval is valid for the entire duration of the study.

No deviations from, or changes of protocol and informed consent document should be initiated without prior return approval by the IEC any deviations or changes of the protocol to eliminate immediate hazards to the trial subjects and about any information that may affect adversely the safety of the subject or the conduct of the trial.

A copy of final report should be submitted to the IEC for the review.

College of Physiotherapy MIRAJ Wanless Hospital

Principal , IEC

Date of approval of study : 06/04/2023

ANNEXURE II INFORMED CONCENT FORM

Participant's Name:

Age: Gender:

Address:

Title of the project: "EFFECT OF GLUTEUS MEDIUS STRENGTHENING EXERCISES ON PAIN AND HIP RANGE OF MOTION IN SUBJECTS WITH TIGHT PIRIFORMIS IN HEALTHY SEDENTARY INDIVIDUALS-A RANDOMIZED CONTROL TRIAL".

The details of the study have been provided to me in writing and explained to me in my own language. I confirmed that I have understood the above study and have the opportunity to ask questions. I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving any reasons. By doing so I am aware that my medical care or legal rights will not be affected. I agree that the data or results obtained from this study can be used only for scientific purpose(s). I fully agree to participate in the above study.

Signature of the participant:_____

Signature of the investigator: _____

Date:

परिशिष्ट 1

माशिती कन्सेंट फॉर्म

नाव : वय: ल िंग: पत्ता:

प्रकल्पाचे शीर्षक : **'शि ेगी बैठी व्यक्ीमीं धेघट्ट पायीफॉशममस असल्याच्या शिषयींमध्ये ि दा आशि शिप ि े ि ज्ञिऑफ मो ि ि ि गलुशटयस मेशिअस स्ट्रेथ्थीगि्यायामींचा परि ाम: यादृच्छिक शियींत्रि चाचि".**

वरी अभ्यासाचे तपशी म ा े खी लि े गे े आहेत आलि म ा माझ्या स्वतः च्या भार्ेत समजावून सा िंलगत े आहे मी पुष्टी े क ी की म ा वरी अभ्यास समज ा आहे आलि म ा प्रश्न लवचारण्याची सिंधी आहे, म ा हे समज े आहे की माझा माझ्या अभ्यासा मधी सहभाग ठीक आहे आलि मी को ित्याही कारिालशवाय काहीही मागे घेण्यास मोकळे आहे असे े कल्याने म ा मालहत आहे की माझी वैद्यकीय सेवा लकिं वा कायि शीर हक्क प्रभालवत हो ार नाहीत. मी सहमत आहे की या अभ्यासामधून प्राप्त े क ा डेटा लकिं वा परिराम े क वळ वैज्ञालनक हेतू िंसाठी वापरल्या जाऊ शकतात, वरी अभ्यासात भाग घेण्यास मी पू ि षपि सहमत आहे.

सहभागीची स्वाक्षरी :

चौकशी करत्याची सही :

ANNEXURE III

DATA COLLECTION SHEET

Name of participants:

Age:

Gender:

Occupation:

Address:

TEST	PRE-INTERVENTION	POST-INTERVENTION
NPRS		
ROM		

Signature of participants - Signature of investigator -

Date: Place:

MASTER CHART

EXPERIMENTAL GROUP=GROUP A

SR NO	AGE	GENDER	RANGE OF MOTION		NPRS	
			PRE	POST	PRE	POST
1	26	M	35	44	38	42
2	41	M	40	45	35	42
3	47	M	35	40	40	45
4	30	M	38	42	40	45
5	40	F	35	45	40	42
6	40	M	39	45	40	44
7	41	M	38	45	38	42
8	26	M	35	42	40	45
9	40	F	38	44	38	44
10	40	M	40	45	38	42
11	35	M	35	42	35	40
12	35	M	35	40	40	45
13	32	M	35	42	40	20

CONTROL GROUP=GROUP B

SR NO	AGE	GENDER	RANGE OF MOTION		NPRS	
			PRE	POST	PRE	POST
1	45	M	38	40	40	42
2	35	M	35	36	35	38
3	48	M	40	42	35	36
4	35	F	38	40	35	38
5	35	M	35	38	40	42
6	25	M	40	42	38	40
7	35	M	30	32	38	42
8	32	M	35	38	42	44
9	45	M	38	40	38	40
10	26	M	38	40	35	36
11	31	M	40	42	42	44
12	30	F	38	40	42	44
13	33	F	38	42	40	42