Effect of Proprioceptive Neuromuscular Facilitation Stretch and Soft Tissue Mobilization Along with Active-Assisted Devices on Piriformis Syndrome Among Females in Sedentary Lifestyle.

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ABSTRACT
AIM:

To find the effectiveness of proprioceptive neuromuscular facilitation stretch and soft tissue mobilization along with active-assisted devices on piriformis syndrome among females in sedentary lifestyle.

MATERIAL AND METHODS: About 30 participants aged between 25 and 45 years females were selected based on inclusion and exclusion criteria. The informed consent form were collected from all the subjects prior the commencement of the study. Experimental protocol and procedure were informed to all subjects before giving their informed consent. These 30 participants were allocated into 2 groups. The participants were categorised as Proprioceptive neuromuscular facilitation stretch (Group A) and soft tissue mobilization along with active-assisted devices (Group B) based on their hip Range of motion (ROM), Lower extremity functional scale and Numerical pain rating scale results. A paired t-test compared hip Range of motion (ROM), Lower extremity functional scale and Numerical pain rating scale scores between groups. The tables were tabulated and statistically evaluated.

RESULTS: The pre-test and post -test values were analyzed, indicating that the PNF stretch group demonstrated significant improvements in pain reduction, muscle tightness and increase range of motion for individuals with Piriformis syndrome compared to Soft tissue mobilization along with active-assisted devices group, with demonstrated by the data with p-value < 0.0001.
DISCUSSION: According to this study, the PNF stretch group had better results when compared to soft tissue mobilization along with active-assisted devices, PNF stretch are more effective in pain reduction, muscle tightness and increase range of motion for individuals with Piriformis syndrome

KEY WORDS:

piriformis syndrome, PNF stretch, muscle tightness, pain, NPRS, Sciatic nerve.

ABBREVATIONS:

PNF- Proprioceptive neuromuscular facilitation, NPRS- Numerical pain rating scale

INTRODUCTION:
Piriformis syndrome is a neuromuscular disorder causes hip and buttock pain that might relate to the low back and thigh. PS can come from any irregularity in the piriformis muscle, including shortening, spasm, hypertrophy, inflammation, and any anatomic variation of the muscle that compresses the sciatic nerve [1]. The sciatic nerve can become irritated and painfully transmit pain down the back of the leg (sciatica) when the piriformis muscles are too tight. Piriformis syndrome is a peripheral neuritis of the sciatic nerve brought on by pressure from an inflamed or injured piriformis muscle or an abnormality of the piriformis muscle [2]. Pain is reduced when the muscle is kept in a relaxed condition because less strain is exerted on the nerve. The nerve is compressed when a muscle contracts, therefore tension is released when the muscle relaxes to retain the nerve in an inactive posture [3].
The piriformis muscle is located in the middle of the buttock, on same plane as the gluteus medius. It comes from three distinct locations. First from the front side of the sacrum by three digitations (S2-4), second from the gluteal surface of

the ilium close to the posterior inferior iliac spine, and third from the capsule of the neighbouring sacroiliac joint, from the upper part of the pelvic surface of the sacrotuberous ligament. The muscle is attached medially to the greater trochanter of the femur's top edge. The upper gluteal artery in the buttock and the lower sacral artery in the pelvis provide this muscle with blood. Branch nerves from L5, S1-2 innervate the muscle [2].Together with the quadratus femoris, superior and inferior gemelli, and obturator internus and externus, the muscle of the piriformis externally rotates the thigh. In particular, during hip extension, this muscles laterally rotates the femur, and during hip flexion, it abducts the same bone. Walking requires femoral abduction because it transfers the body's weight to the other side and keeps one from falling. Additionally, the piriformis marks the gluteal region. The muscle splits into both upper and lower segments after passing through the higher sciatic foramen and almost completely filling the notch. The anatomical relationship of certain gluteal nerves and blood vessels with the piriformis gives rise to their names. For instance, the piriformis is superior to the superior gluteal nerve and vessels. The vessels and inferior gluteal nerve travel inferiorly. Beyond the piriformis, all other nerves and blood vessels leave the pelvis [4]. This muscle supports stability during standing and walking in addition to serving as the hip joint's weak flexor, weak abductor, and lateral rotator. When the hip joint is flexed to less than or equal to 60^{o}, it functions as a lateral rotator.

As the angle of hip flexion increases beyond 60^{o}, the piriformis muscle transitions into an internal rotator. Thus, even though its function varies with different movements, the piriformis remains active during any type of sitting position, including high and cross-sitting

Piriformis syndrome may be responsible for 0.3% and 6% of all occurrences of low back pain and/or sciatica, piriformis syndrome may be to blame. The incidence of piriformis syndrome would be about 2.4 million per year, with an estimated 40 million additional occurrences of low back pain and sciatica per year. Piriformis syndrome often affects middle-aged patients, with a reported 1:6 ratio of male to female patients affected [5]. Because biomechanics associated with wider quadriceps femoris muscle angle and in os coxae (pelvis) women [6].

PS is divided into two categories according to the causes: A split sciatic nerve or piriformis muscle is one anatomical aetiology of primary PS, which affects less than 15% of cases. A triggering factor, such as trauma (around 50%), vascular mass effect, or local ischemia, results in secondary PS [1]. Trauma to the hip area that can lead to piriformis muscle edema, piriformis muscle hypertrophy from excessive exercise and compression of the piriformis muscle by prolonged sitting [7]. The most common cause of piriformis syndrome is macro trauma to the buttocks, which can result in soft tissue inflammation, muscular spasms, or both, and nerve compression. Excessive usage of the piriformis muscle, such as while long-distance walking or running, or direct compression can cause micro trauma [5]. When piriformis muscle spasms, the sciatic nerve is compressed, which results in symptoms that are nearly identical to those of sciatica: pain, tingling, and numbness.

Usually, the piriformis condition causes this. Tingling, numbness, and pain radiating from the back of the foot are among the symptoms. Intermittent in nature, pain worsens with certain actions, such as sprinting or jumping. Sciatica or buttock pain are also synonymous with piriformis syndrome [3].

The most often reported symptoms included buttock pain, pain that was made worse by sitting, external tenderness close to the greater sciatic notch, pain with any motion that tightened the piriformis muscle, and restriction of straight leg raising [8]. Patients with PS typically report pain that worsens after 15 to 20 minutes of walking, standing, or lying down. This pain may or may not radiate from the sacrum through the gluteal region to the back of the leg. The Piriformis muscle flexibility was assessed objectively byadapting the Piriformis Test [9].The Beatty's test, the Pace manoeuvre, and the Flexion, Adduction, and Internal Rotation (FAIR) test are a few of the manual procedures used to diagnose piriformis syndrome[3]. Physical examinations typically reveal the presence of the buttocks pain during hip flexion in conjunction with either passive internal rotation or active external rotation of the hip. During biomechanical evaluation, tightness in the lumbosacral muscles and limited external rotation of the hip have also been noted [10]. Deep lateral directed palpation during pelvic or rectal examination exacerbates it. A trigger point may also be located over the piriformis muscle and radiate down the sciatic distribution. A comprehensive neuromuscular assessment ought to be carried out. The diagnosis of PS is less likely if weakness or sensory loss is experienced, with the exception of more chronic presentations when secondary disuse atrophy may be evident.

Other conditions may coexist with piriformis syndrome. This could be taken into account during a differential diagnosis. Any buttock trauma, the existence of bowel and bladder issues, lumbosacral radiculopathies, degenerative disc disease of the discs, compression fractures, and spinal stenosis are all possible differential diagnoses.Sacroiliac joint dysfunction and 22 sacroilliatis are also thought to be potential causes of piriformis syndrome. In differential diagnosis, hip diseases such as bursitis and arthritis as well as fractures should be taken into account.

In patients who may have piriformis syndrome, the obturator internus muscle, which is also an external rotator of the hip, has been proposed as a potential contributing factor to sciatic neuritis [11].

The treatment of PS Involves both surgical piriformis release surgery and sciatic nerve decompressionand non-invasivepharmacological and therapeutic therapies interventions. Physiotherapeutic techniques include hip abductor strengthening, massage, biomechanical anomaly repair, core stability drills, and soft tissue and joint mobilization [12].Sedentary people often report having low back pain due to muscular imbalance, which can lead to chronic discomfort in the lower back if left untreated. A healthy sedentary lifestyle is characterized by sedentary employment [8]. Proprioceptive neuromuscular facilitation, or PNF stretching, is a type of flexibility training that can lessen hypertonus, enabling muscles to loosen up and lengthen. Proprioceptive muscular facilitation, or PNF for short, is widely regarded as one of the best stretching techniques available.By encouraging muscle elongation, early PNF techniques helped people with stiffness and weakness recover. Theoretically, this is achieved by strengthening the muscle through improved inhibitory mechanisms that affect the spastic muscle.

The goal of the Proprioceptive neuromuscular facilitation techniques Is to promote functional movement through facilitation, inhibition, strengthening, and relaxation of muscle groups. The techniques use concentric, eccentric, and static muscle contractions[5]Thepurpose of stretching is to lengthen the piriformis muscle, which had contracted and was compressing the sciatic nerve [13]. PNF techniques helps in the development of joint stability, mobility, strength and endurance of the muscles, neuromuscular control, and coordination, all of which are intended to increase the patients' overall functional ability. Because all normally coordinated human movements take place in spiral or a diagonal motions, PNF patterns of movement were created. Skeletal The strongest and most synchronised contractions occur during these movement patterns that are diagonal. These are diagonal Patterns necessitate rotation of the extremities Central stability."The most effective method of exercise for flexibility available to you to improve the range of motion (ROM)" is most likely PNF stretching. This is a more sophisticated kind of flexibility training where the targeted muscle group is stretched as well as contracted [14]

Soft-tissue mobilization (STM) is a system of manual techniques employing low-load, long-duration forces applied in approximation, traction to improve mobility between overlying and adjacent connective tissue layers throughout the body [12]

These methods have shown to be a successful way to lessen the surrounding muscles' compression of the sciatic nerve. At the tenoperiostial junctions, specifically at the gluteus maximus and minimus attachments, as well as the greater trochanter and sacrum attachments of the piriformis, transfer fibre frictions were applied for a few minutes [11]

MATERIAL AND METHODS: About 30 participants aged between 25 and 45 years females were selected based on inclusion and exclusion criteria. The informed consent form were collected from all the subjects prior the commencement of the study. Experimental protocol and procedure were informed to all subjects before giving their informed consent. These 30 participants were allocated into 2 groups. The participants were categorised as Proprioceptive neuromuscular facilitation stretch (Group A) and soft tissue mobilization along with active-assisted devices (Group B) based on their hip Range of motion (ROM), Lower extremity functional scale and Numerical pain rating scale results. A paired t-test compared hip Range of motion (ROM), Lower extremity functional scale and Numerical pain rating scale scores between groups. The tables were tabulated and statistically evaluated.

ETHICAL CLEARANCE: Taken from institutional ethical committee. International scientific Review Board Number: XX/XXX/XXXX/ISRB/SR/SCPT.

Date:22/09/2023

ISRB NO: XXXXXXXXX

PROCEDURE:

Subjects diagnosed with piriformis syndrome will be screened for Proprioceptive neuromuscular facilitation stretch and soft tissue mobilization along with active-assisted devices

Following the sample calculation based on tightness of muscle, pain, reduced ROM of hip. All the selected will be done using proprioceptive neuromuscular facilitation stretch and soft tissue mobilization along with active-assisted devices.

Randomization of the samples into the two groups GROUP A Proprioceptive neuromuscular facilitation and GROUP B Soft tissue mobilization along with active-assisted devices.

Group A of 15 subjects with piriformis syndrome will be assigned Proprioceptive neuromuscular facilitation stretch for 5 repetitions of the contract relax for piriformis muscle followed by a PNF facilitated hip flexion and external rotation pattern for 12 session over two weeks period.

Group B of 15 subjects with piriformis syndrome will be assigned soft tissue mobilization for 7 minutes along with active-assisted devices exercises for 3 reps for 12 session over two weeks period.

Treatment protocol

PNF stretching, also known as proprioceptive neuromuscular facilitation, is a form of flexibility exercise that helps reduce hypertonus and allow muscles to expand and relax up. PNF, or proprioceptive muscular facilitation, is considered one of the best stretching methods known. Early PNF treatments promoted muscular elongation, which aided in the recovery of individuals experiencing stiffness and weakness. In theory, this is accomplished by fortifying the muscle via enhanced inhibitory pathways that impact the spastic muscle.

The purpose of the procedures for proprioceptive neuromuscular facilitation aims to encourage functional mobility by strengthening, relaxing, inhibiting, and facilitating muscular groups. Muscle contractions that are static, eccentric, and concentric are used in the procedures. Stretching is done by lengthening the piriformis muscles, which was pinching the sciatic nerve when it constricted.

GROUP A (Proprioceptive neuromuscular facilitation stretch)

Positioning the patient

The patient is in a supine position, laying on their back. This indicates that their back rests against the bed or treatment table they are lying on.

Hip Flexion to Ninety Degrees: The therapist elevates the patient's leg to a 90-degree angle of flexion on the hip. This entails raising the patient's leg to the point where the thigh is level to the back, resulting in a right hip angle.

External Hip Rotation: The patient's hip is externally rotated by the therapist while it is positioned in a 90-degree flexed position. Rotating the thigh outward and away from the body's midline is known as external rotation.

Isometric contraction:

The piriformis muscle is to be contracted by the patient. The piriformis is a deep, tiny muscle located in the buttocks that is usually contracted by pressing or squeezing the muscle. For seven seconds, this contraction is maintained.

Therapist's Gentle tension: The therapist simultaneously gives the piriformis muscle some gentle tension. It is possible that the therapist applies this resistance manually, going opposing the motion of the contractions of the muscles. The objective is to ensure that an individual is not straining by establishing controlled and submaximal effort.

Seven second duration:The piriformis contractions and the provider's resistance are held for a certain amount of time—in this case, seven seconds. This duration was probably selected with therapeutic considerations in mind, and it might be changed dependent on the intervention's objectives and the patient's tolerance.

Submaximal Effort: The patient's effort should be kept to a minimum. This is the main focus. This indicates that controlled and moderate intensity of muscle contraction is preferable to one at maximal strength. The goal of this strategy is to avoid undue stress or pain when exercising.

Relaxation:

Release the contraction and relax the muscle for 15-30 seconds. Focus on letting the muscle completely relax during this phase
After relaxation, passively stretch the muscle further for 5 repetitions

GROUP B (Soft tissue mobilization along with active-assisted devices)

Soft-tissue mobilization (STM) is a manual method system that improves mobility between overlying and contiguous connective tissues layers throughout the body by applying low-load, long-duration stresses in approximation and traction. These techniques have proven to be an effective means of reducing the sciatic nerve's compression by the surrounding muscles. Transfer fiber frictions were applied for a short while at the tenoperiostial junctions, more precisely at the maximus of the gluteus and minimus attachments and the greater trochanter and sacral attachments of the piriformis.

Palpation: Begin through determining the bony landmarks in order to locate the midpoint between the sacrum and the outermost part of the hip. You can palpate the hip joint and the sacrum; find the midpoint by applying slight pressure with your fingers.

Mobilization: Using your elbow, gently press on the designated point. This can encourage muscle relaxation and help release tension. Maintain contact with the patient throughout the mobilization process to ascertain how comfortable they are.

Hip Rotation: Include hip rotation in the mobilization technique. Through the engagement of a wider range of muscle fibers, such dynamic movement can increase to improve the efficacy of the intervention.

This procedure is done for 7 minutes so the muscle is relaxed.

EXERCISE WITH ACTIVE ASSISTED DEVICES ALONG WITH SOFT TISSUE MOBILIZATION.

Seated Piriformis Stretch Using Cane or Dowel

Device: Wooden dowel, stick, or cane

Procedure:

Sit upright in a chair.

Cross one ankle over the opposite knee.

Use a cane to gently press down on the raised knee, deepening the stretch.

Keep your back straight and lean forward slightly if tolerated.

Duration: Hold 20–30 seconds, repeat 2–3 times

Goal: Isolate and stretch piriformis with mild external force.

Hip Circle Band Lateral Walks

Device: Hip circle band or heavy resistance loop

Procedure:

Place the band above your knees.

Slightly bend your knees and step side to side (like a crab walk).

Maintain tension in the band throughout the movement.

Reps/Sets: 10–15 steps each direction, 2–3 sets

Goal: Strengthen gluteus medius and stabilize piriformis

OUTCOME MEASURE:

A) RANGE OF MOTION (ROM)

Actively measuring the ROM of the afflicted hip with a universal goniometer. The hip's abduction and external rotation were Measured. Normal ROM for abduction-45, external rotation-45 Measurements of hip ROM in goniometer

Abduction: To measure abduction of hip patient is supine in anatomical position. Fulcrum is placed in line with the anterior superior iliac spine. The moving arm of the goniometer is aligned with the midline of the patella, the stationary arm with the ASIS of the opposite side. Movement: abduction until the motion is detected at the opposite anterior superior iliac spine.

External rotation

To measure external rotation of hip the patient sitting on table. Knee flexed. Stabilize distal thigh and hip laterally (externally) rotated

B) LOWER EXTREMITY FUNCTIONAL SCALE

Lower extremity function can be measured using the well-known and validated lower extremity functional scale (LEFS), a type of patient-rated outcome measure (PROM).

The LEFS has 20 items in 4 categories. For each question, 0 to 4 points can be earned, so 80 points can be earned in total—indicating maximal lower extremity function. These groups consist of activities with increasing physical demands. Questions on activity vary from walking between rooms to running on uneven ground. The LEFS is used for measuring lower extremity function in a wide variety of disorders and treatments

C) NUMERICAL PAIN RATING SACLE (NPRS)

An instrument used to gauge a person's level of pain is the Numeric Pain Rating Scale (NPRS Score). It is a straightforward yet efficient system that rates a person's level of Discomfort on a scale of 0 to 10 None, 0–1, mild, 3–6, medium, and severe. Explain that the NPRS is a numerical scale with a range of 0 to 10, with 0 denoting no pain And 10 denoting the most excruciating pain possible. The participant was asked to self assess their current level of pain by choosing a number on the NPRS scale. Record the Chosen number on the NPRS scale as the participant's pain score.

RESULTS

The results of the statistical analysis revealed that the differences between the values of the two groups were statistically significant. Using descriptive and inferential statistics, the acquired data was tabulated and evaluated. The mean and standard deviation (SD) were applied to all parameters. The Pre-test and Post-test values were analyzed, indicating that the Piriformis stretch group demonstrated significant improvement compared to the Soft tissue mobilization, with **"**p-value**"** 0.0001 indicating superior outcomes for the Piriformis stretch group. Thus Piriformis stretch group is considerably effective than Soft tissue mobilization along with active-assisted devices Group in piriformis syndrome among females in sedentary lifestyle.

Table 1: Pre and Post test value for range of motion in PNF group and Soft tissue mobilization along with active-assisted devices group for abduction

		Mean	SD	T value	P value
PNF Stretch	Pre test	29.70	3.83	20.6382	<0.0001
	Post test	42.73	3.16		
Soft Tissue Mobilization along with active-assisted devices	Pre test	28.97	3.19	21.1525	<0.0001
	Post test	34.97	2.28		

Table 2: Pre and Post test value for range of motion in PNF group and Soft tissue mobilization group for external rotation

		Mean	SD	T value	P value
PNF Stretch	Pre test	31.40	2.46	50.1235	<0.0001
	Post test	43.50	2.39		
Soft Tissue Mobilization along with active-assisted devices	Pre test	29.43	3.27	28.4457	<0.0001
	Post test	34.80	2.85		

Table 3: Pre and Post test value for LEFS scale for PNF group

	Mean	SD	T value	P value
Pre test	47.63	7.20	17.3419	<0.0001
Post test	53.53	7.14		

Table 4: Pre and Post test value for LEFS scale for soft tissue mobilization along with active-assisted devices group

	Mean	SD	T value	P value
Pre test	51.63	9.29	21.3601	<0.0001
Post test	63.87	8.27		

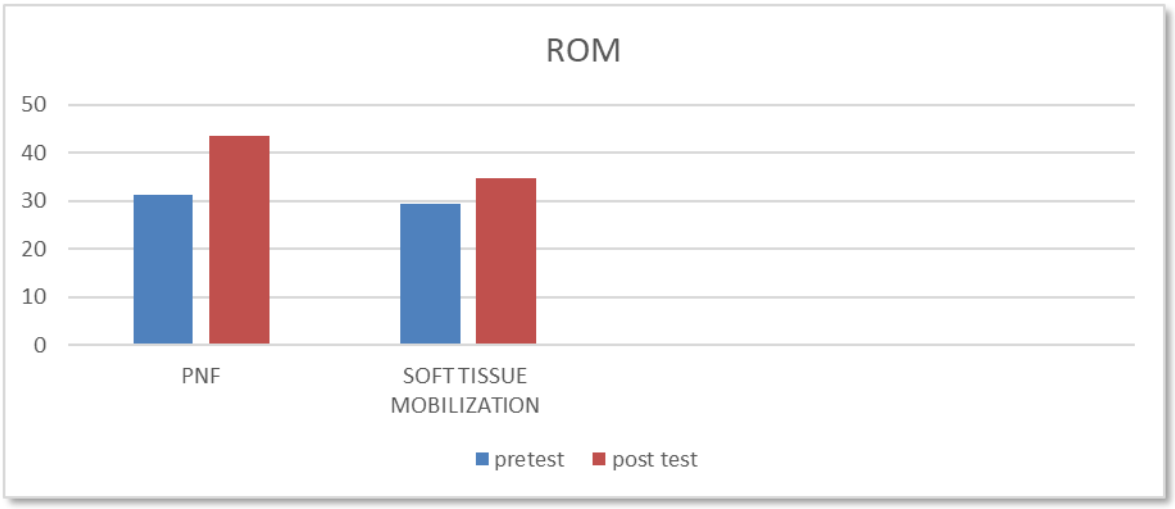
Table 5: Pre-test and Post-test values for NPRS scale for PNF group

	Mean	SD	T value	P value
Pre-test	7.27	1.17	23.6942	<0.0001
Post-test	4.27	1.05		

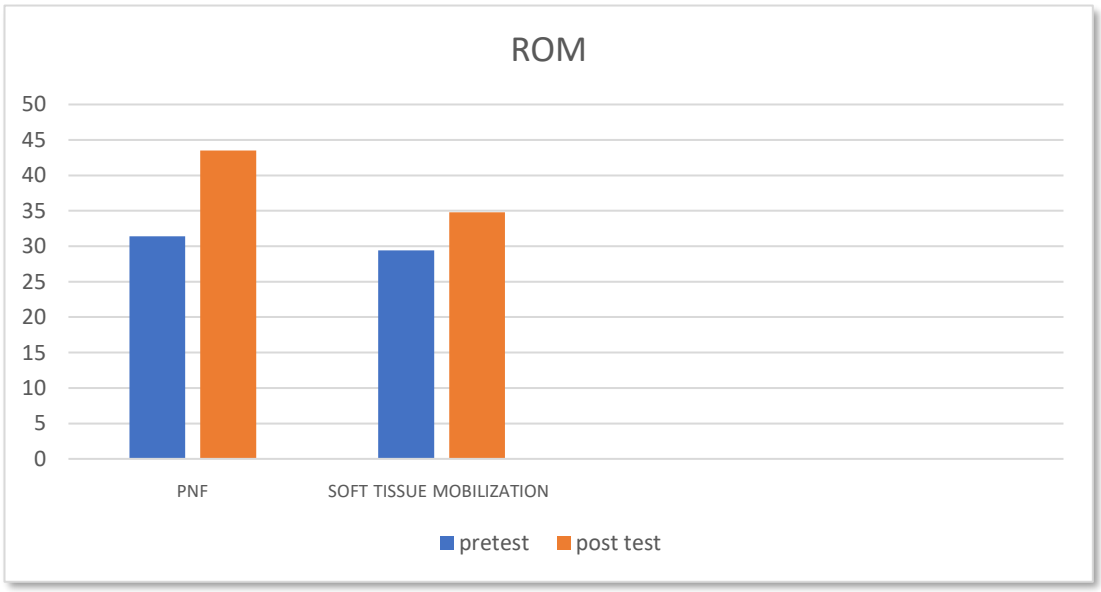
Table 6: pre- test and post-test values for NPRS scale for soft tissue mobilization along with active-assisted devices

	Mean	SD	T value	P value
Pre- test	7.30	0.95	15.5591	<0.0001
Post-test	5.30	0.65		

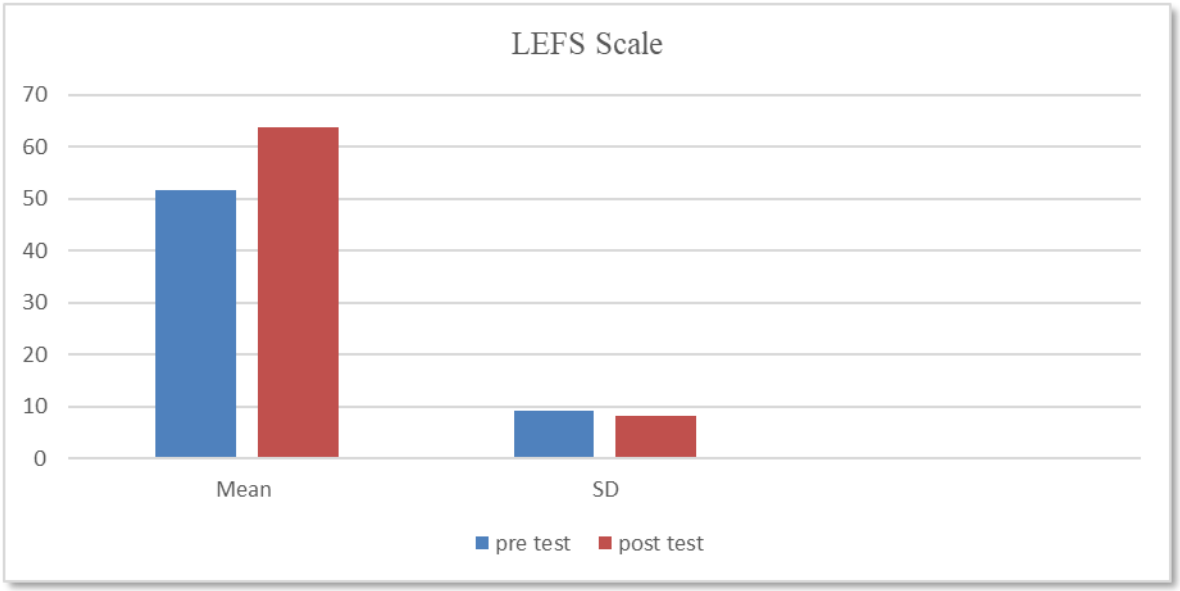
FIGURES:



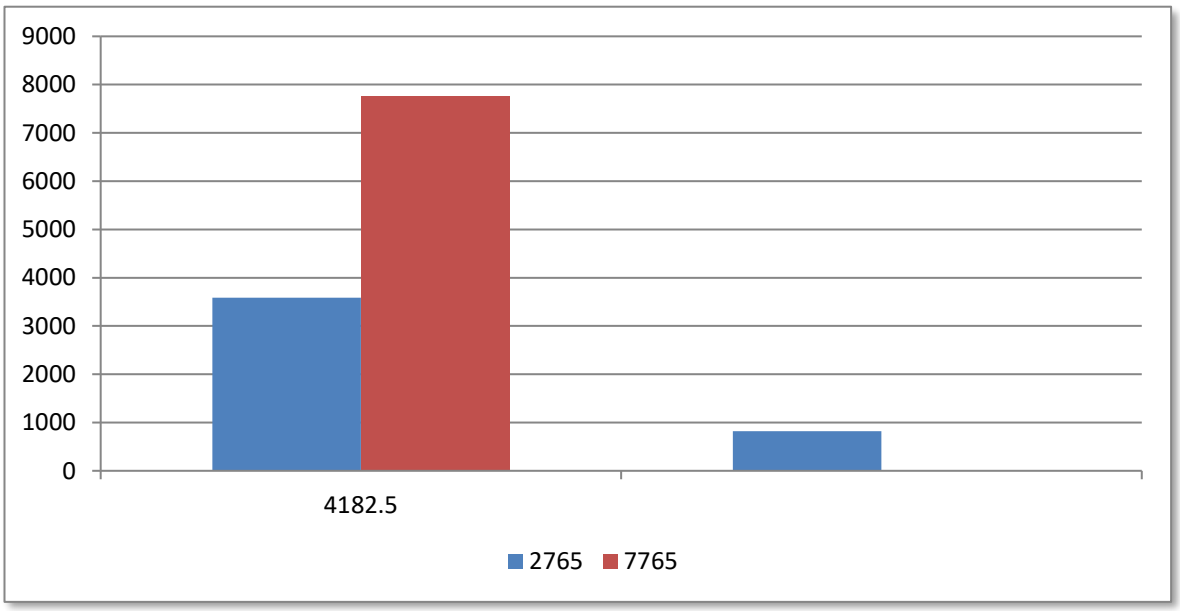
Graph 1: Pre and Post test value for range of motion in PNF group and Soft tissue mobilization along with active-assisted devices group for abduction



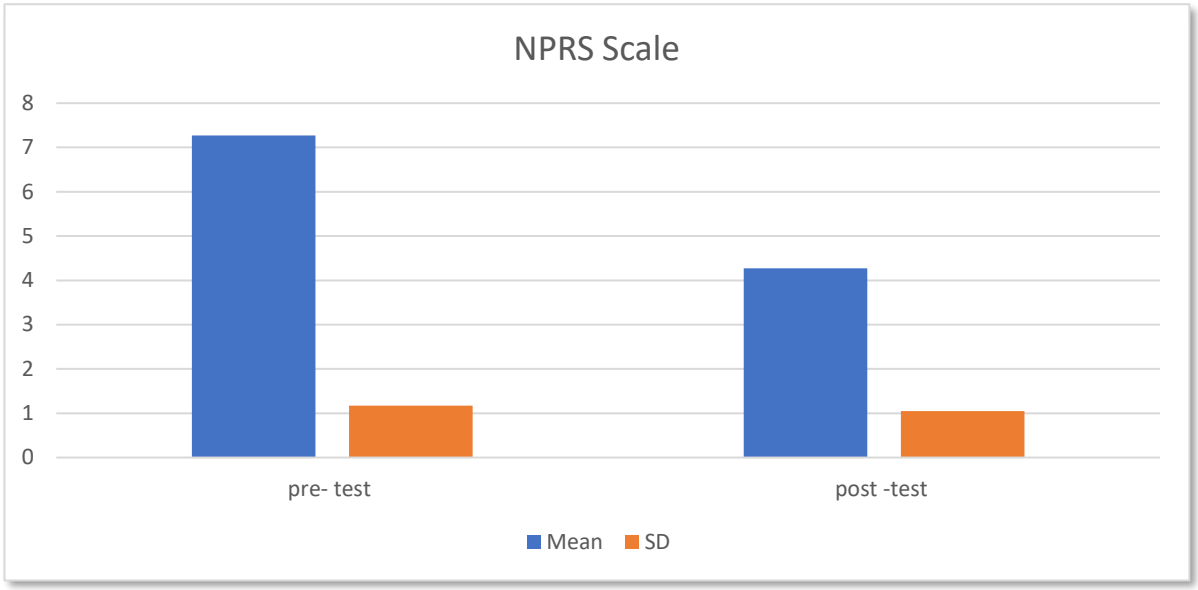
Graph 2: pre and post test value for range of motion in PNF group and Soft tissue mobilization along with active-assisted devices group for external rotation



Graph3: Pre and Post test value for LEFS scale for PNF group

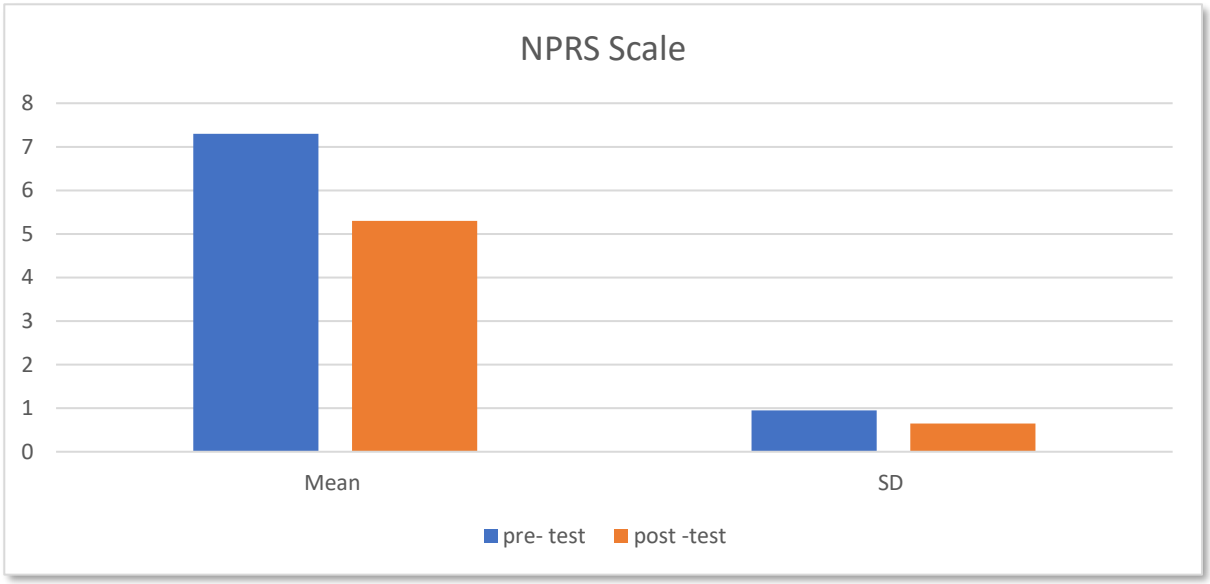


Graph 4: Pre and Post test value for LEFS scale for soft tissue mobilization along with active-assisted devices group



Graph 5: Pre-test and Post-test values for NPRS scale for PNF group

Graph 6: Pre- test and Post-test values for NPRS scale for soft tissue mobilization along with active-assisted devices



DISCUSSION

Piriformis syndrome is a neuromuscular disorder causes hip and buttock pain that might relate to the low back and thigh. PS can come from any irregularity in the piriformis muscle, including shortening, spasm, hypertrophy, inflammation, and any anatomic variation of the muscle that compresses the sciatic nerve.

The sciatic nerve can become irritated and painfully transmit pain down the back of the leg (sciatica) when the piriformis muscles are too tight. Piriformis syndrome is a peripheral neuritis of the sciatic nerve brought on by pressure from an inflamed or injured piriformis muscle or an abnormality of the piriformis muscle.

Pain is reduced when the muscle is kept in a relaxed condition because less strain is exerted on the nerve. The nerve is compressed when a muscle contracts, therefore tension is released when the muscle relaxes to retain the nerve in an inactive posture

In this study, 30 subjects were selected using inclusion and exclusion criteria. The subjects were divided into two groups: the PNF Group (n=15) and the Soft tissue mobilization along with active-assisted devices Group (n=15). Both groups received the exercise intervention for 2 weeks. Both were assessed using pre-test and post-value measurements of the ROM of hip, LEFS scale and NPRS scale.

Even though soft tissue mobilisation along with active-assisted devices and proprioceptive neuromuscular facilitation stretch have both demonstrated encouraging results in improving the outcomes for people with piriformis syndrome, research is necessary to determine the effectiveness of each intervention in terms of reducing pain and improving range of motion and muscle tightness. Rehabilitation technicians would be able to create more individualized plans for intervention for each patient based on their unique needs thanks to the insightful information this study will provide them.

According to this study WAQARAHMED et.alconcluded that soft tissue mobilization techniques that can help reduce or even completely eradicate piriformis syndrome. By releasing tension and increasing flexibility in those soft tissues that surround the piriformis muscle, these techniques hope to lessen sciatic nerve compression. Applying these techniques on a regular basis may help address the underlying causes of piriformis syndrome while also promoting healing, improving blood flow, and easing symptoms. It’s crucial to remember that each person may react differently, and for effective management, a comprehensive strategy that includes good posture and exercise is frequently advised [11]

Jonathan et.al stated that Patrick Stretching and physical therapy techniques have traditionally been the mainstays of PS treatment, with anesthetic and cortico steroid injections into the piriformis muscle origin, abdomen, muscular sheath, or sciatic nerve sheath also being given to resistant patients. Rest and abstain from activities that make your symptoms worse.Anti-inflammatory drugs to control inflammation and pain.Applications of heat or ice.Cases that are resistant. More intrusive procedures may be taken into consideration in certain refractory cases where conservative therapies and injections are insufficient to relieve the patient's symptoms. These could involve piriformis muscle release surgeries or treatments for any other underlying causes. [23]

Surburg Schrader et.al has concluded that the isometric contraction of the limited muscle occurs after the restricted muscle has been passively stretched into place. To prevent muscle fatigue and injury, the majority of isometric contractions used in the PNF stretching techniques should be held for at least three seconds at a submaximal effort. The patient is told to relax the constricted muscle that was just contracting and contract the opposing muscle to extend the limb further after the contraction period. It is generally true that, in order to prevent excessive exhaustion and lower the risk of damage, isometric contractions used in PNF stretching are frequently carried out at submaximal intensity. It is customary to hold the contraction for three seconds or longer; however, this time may differ depending on the particular PNF technique being used. [14]

Sharman et.al has concluded In order to improve both active and passive range of motion and improve motor performance and rehabilitation, proprioceptive neuromuscular facilitation (PNF) stretching techniques are frequently employed in clinical and athletic settings. The best stretching method for increasing passive range of motion, according to the literature, is PNF stretching. PNF stretching has a reputation for improving range of motion both in the active and passive domains. Flexibility and joint mobility are improved by a combination of passive stretching, an isometric contraction, and relaxation.PNF stretching is frequently used to enhance motor function. Better neurological control and coordination are facilitated by the neuromuscular aspects of PNF, which include proprioceptor activation and muscle contractions. Athletes and those who engage in other activities involving precise and controlled motions may find this very helpful. The stretching of the PNF can be an effective part of rehabilitation and exercise programs when used with individual requirements and safety in mind.

An investigation by Gonzalez-Rave et al. looked at increases in the hip and shoulder joints' ranges of motion. Compared to other groups, they saw greater increases in the joint ranges of motion in the PNF-treated group. PNF is widely employed as a therapeutic strategy to address physical dysfunction brought on by injury or illness. The results of the study, which showed that the PNF-treated group's hip ranges of motion increased more than the other group's, highlight how successful PNF techniques are in increasing flexibility. These gains are thought to be a result of the combination of gentle stretching, isometric tightening, and consequent relaxation in PNF. In fact, PNF is frequently used as a therapeutic approach to address physical dysfunction resulting from a variety of conditions, such as disease or injury .The findings of the study may have therapeutic ramifications, indicating that PNF could be a beneficial intervention for people looking to increase the flexibility of their hip and shoulder joints. Physicians and experts in rehabilitation may

Mulla and Gosavi'set.al made study, on "Effect of neural tissue mobilisation and stretching exercise in piriformis syndrome," forty-two people who had experienced PS participated in the study that was done. . The study's conclusions demonstrated that, when it comes to treating piriformis syndrome, neural tissue mobilisation in addition to traditional physiotherapy treatment has a highly significant impact compared to conventional physiotherapy treatment alone[3]

Stretching techniques have also been shown to be beneficial for treating piriformis syndrome. Suwarni et al.'s research revealed that applying stretching and TENS together was more successful at reducing pain in piriformis syndrome patients than just reducing pain alone.

The value indicates that there is a significant distinction in the result before and following the ultrasound intervention and piriformis muscle stretching, according to the hypothesis tested using the results of the paired sample test. The results indicate a decline in the Visual Analogue Scale value following the application of Piriformis Stretching and Ultrasound.

Stretching the piriformis relaxes the tense muscle, which relieves compression on the sciatic nerve and improves symptoms Kisrschner et al..Stretching enhances physical performance, lowers pain in the muscles, promotes flexibility, and guards against injury. A musculotendinous unit's length is typically increased through stretching, and muscle tension is typically inversely correlated with length: lower muscular tension is associated with longer muscles, while higher muscular tension is associated with shorter muscles. Stretching a muscle inevitably causes tension to be applied to other structures, such as the fascia and joint capsule, which are composed of different tissues than muscles and have distinct biomechanical characteristics [22]

In their review, Boyajian-O'Neill et al. note that numerous studies have used a variety of physiotherapy techniques to treat PS. The use of massage, therapeutic ultrasound, cold and hot compresses, exercises, and stretching are all considered very effective interventions, according to the authors. More precisely, they state that the major objective of physiotherapy treatments is to reduce patients' symptoms while enhancing their range of movement of the tendons and muscles. This will boost the person's functioning and support by increasing muscle strength. Additionally, they state that these patients have benefited from adductor muscle training[5]

Proprioceptive Neuromuscular Facilitation (PNF) stretches and massage therapy work well together to manage myofascial pain trigger points, according to a study by Trampas et al. The pressure pain threshold has increased, which indicates that the integrated treatment is having a positive effect. The group's relief highlights the potential advantages of a combination of methods and highlights the significance of treating muscle tension with massage and flexibility with PNF techniques. The long-term impacts and relative efficacy of this mixed therapeutic approach in the treatment of myofascial pain could be investigated in more detail[18]

LIMITATION:

Short Sample size: This study had a small sample size of 30participants which Were divided into each group. A large sample size would provide more outcomes That are more reliable and generalizable will increase the findings' validity and Dependability, this study conducted within a short duration time, Only middle aged people were included in the study.

RECOMMENDATION:

The Future study should be concluded with longer treatment of sample ,in future, the study should be done with large number of sample, in the upcoming studies, the study might include the elderly population,the future study should try the study at different settings.

CONCLUSION

According to this study, Proprioceptive neuromuscular facilitation group had better results when compared to the Soft tissue mobilization along with active-assisted devices group. The finding demonstrate significant improvements in pain level and ROM and reduce muscle tightness following the intervention. These positive outcomes align with recent emphasizing the benefits of range of motion on hip function. PNF stretch show potential for piriformis syndrome, restoring the hip function, enhance ROM and reduce muscle tightness.

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ANIMAL AND HUMAN RIGHTS STATEMENT:

For human research, an informed consent process is vital. This section answers how participants are provided with all necessary information, including potential risks and benefits, and how their consent is documented. The study will follow esuring informed consent is obtained and participants' privacy is respected. All participants will have the right to withdraw at any time without consequence. The study will aim to minimize discomfort and will provide support services if needed.

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