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Effectiveness of Muscle Energy Technique among Piriformis Syndrome Patients with Pain, Disability, and Limitations in Internal Rotation Range of Motion of Hip Joint : A Systematic Review

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Abstract: ***Introduction: Piriformis syndrome (PS), also known as pseudo sciatica or pseudo disc, is defined as a neuritis of the branches of the sciatic nerve caused by pressure from an injured or irritated piriformis muscle; mimics the signs and symptoms of low back pain. Due to high incidence of low back pain in our society, P.S frequently goes unrecognized or misdiagnosed in clinical settings. Piriformis syndrome occurs when the sciatic nerve becomes compressed or irritated due to the piriformis muscle, which is located deep in the buttock region. This condition can lead to pain in the lower back, hip area, and the back of the thigh, often radiating down to the leg and the outer part of the foot along the sciatic nerve pathway. Symptoms may worsen with prolonged sitting, stair climbing, or specific movements. Patient experiences pain, numbness, burning sensation, painful bowel Movements, trouble with walking and performing other functional activities. If untreated, it causes problems with prolonged sitting, walking and long standing. Methodology: A comprehensive literature review was performed, identifying 30 relevant studies, out of which 10 met the inclusion criteria. These studies involved varied populations and intervention approaches, highlighting the benefits of Muscle Energy Techniques (MET) in reducing pain, increasing flexibility, enhancing the internal rotation (IR) range of motion (ROM) of the hip joint, and improving the overall quality of life in individuals with piriformis syndrome. Discussion: This review analyzes the outcomes of the selected studies, highlighting the effectiveness of Muscle Energy Techniques (MET) interventions. It also identifies limitations such as small sample sizes and the lack of direct comparative studies. The findings emphasize the need for further research to establish standardized treatment protocols and assess these interventions in broader and more diverse populations. Conclusion: The findings of this study suggest that the Muscle Energy Technique (MET) is an effective intervention for patients with piriformis syndrome in reducing pain, improving functional ability, and increasing internal rotation range of motion (ROM) of the hip joint. Participants who underwent MET demonstrated significant improvements in pain relief, as measured by standardized pain assessment scales, and experienced enhanced mobility in daily activities. Additionally, the increase in hip joint internal rotation ROM indicates that MET effectively addresses muscle tightness and dysfunction associated with piriformis syndrome.***

Keywords: Piriformis syndrome, MET, VAS, ODI, IR ROM

1. Introduction

Piriformis syndrome (PS), also known as pseudo sciatica or pseudo disc, is defined as a neuritis of the branches of the sciatic nerve caused by pressure from an injured or irritated piriformis muscle[1]. The term "sciatica" was coined in Florence in the 15th century to describe leg pain believed to originate from the ischium[2]. Historically, the term has been associated with intervertebral disc pathology, leading to pain radiating down the lower extremity posteriorly[2].

PS is a painful musculoskeletal condition characterized by symptoms such as buttock or hip pain[3]. There are two types of PS:1) Primary PS: Caused by anatomical variations like a split piriformis muscle or a split sciatic nerve[4]. 2)Secondary PS: Results from precipitating factors such as macrotrauma, local ischemia, microtrauma due to overuse, or direct compression (e.g., "wallet neuritis")[5]. In approximately 50% of cases, PS is caused by macrotrauma to the buttocks[5].

PS most frequently occurs during the 4th and 5th decades of life and affects individuals across various occupations and activity levels[6]. The reported incidence rate of PS among patients with low back pain varies widely, ranging from 0.3% to 36%[7]. It is more common in women than men, with a ratio of 6:1, possibly due to biomechanical factors such as a wider Q-angle in the pelvis[8]. A Morton foot can predispose individuals to develop PS[9]. High-risk populations include skiers, truck drivers, tennis players, and long-distance cyclists[10] The condition was first described by W.Yeoman in 1928[11]. Robinson later delineated five salient features[12](1) History of local trauma.(2) Pain localized to the sacroiliac joint, greater sciatic notch, and piriformis muscle, extending along the course of the sciatic nerve and causing difficulty in walking.(3) Acute pain triggered by activities such as stooping or lifting.(4)Palpable spindle- or sausage-shaped mass at the anatomical location of the piriformis muscle.(5)Positive Lasegue sign. Pace and Nagle have reported dyspareunia as a symptom of PS[13]. Steiner et al. found the most common trigger area to be located 3 cm caudal and lateral to the midpoint of the lateral border of the sacrum[14]. Another positive sign of PS is persistent external rotation of the ipsilateral foot ("splay foot"), which is easily detectable when lying supine[15]. Range of motion evaluation may reveal decreased internal rotation of the ipsilateral hip in such cases[16].

Diagnostic tests for PS include the FAIR test, Freiberg's test,

Lasegue's test, and the Pace and Beatty maneuvers, all of which may show positive signs for PS[17]. Electromyography (EMG) can be beneficial in differentiating PS from intervertebral disc herniation[18]. MRI and CT scans may reveal enlargement of the piriformis muscle and are most useful in ruling out disc and vertebral pathologic conditions[19].

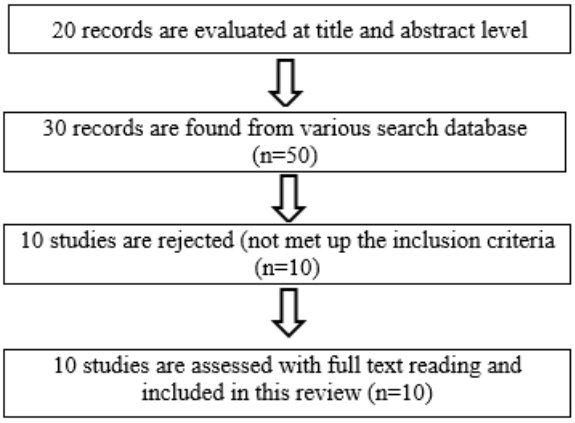
Several studies have reported that physical therapy modalities such as heat therapy, cold therapy, and ultrasound therapy, along with stretching of the piriformis muscle, have beneficial effects on treatment[20]. Manual therapy approaches may combine muscle stretches, muscle energy techniques (MET), soft tissue, and myofascial techniques to address all somatic dysfunctions in patients with PS[21].

In this study, the aim is to evaluate the effect of MET combined with deep friction massage over a standard physiotherapy regimen (ultrasound therapy and stretching) in managing piriformis syndrome[22]. Leon Chaitow and Judith Walker Delany have recommended the use of MET in stretching the piriformis muscle[23]. One such technique, post-isometric relaxation (PIR), operates on neurophysiological principles, stating that after a muscle is contracted, it enters a relaxed state for a brief period, causing sustained activation of the Golgi tendon organs[24]. This response appears to reset the tendon and muscle to a new length by inhibiting it[24]. In 1984, Lewit K. discussed the usefulness of MET in treating trigger points in myofascial pain, highlighting its effectiveness in restoring the resting length of the affected muscle[25].

Cyriax and Russell have employed a technique called deep friction massage[26]. The purpose of friction massage is to maintain mobility within the soft tissue structures of ligaments, tendons, and muscles, and to prevent the formation of adherent scars[27]. According to D. Bruce Fligg, direct pressure in chronic cases of PS helps break down fibrositic adhesions.

2. Method

Studies were search from the following search engine PubMed, Google scholar, ResearchGate and Cochrane Library to review the literature. Studies include that Investigate effectiveness of MET in piriformis syndrome patients. Keyword used to search studies are MET, ODI, NPRS, IR ROM of hip joint.



Several studies have shown that MET, UST, conventional therapy helps in piriformis syndrome patients, in improving ROM, pain and disability and quality of life.

Author, journal, Year	Objective	Design	Characteristics of participants sample size	Method	Outcome measures	Results
2010[28]	To evaluate the effectiveness of Post-Isometric Relaxation (PIR) compared to conventional stretching exercises, following the application of a hot pack, on functional outcomes.	Experimental	30 individuals, aged 25	A total of 30 individuals, aged 25, experiencing back pain and seeking treatment at the Physical Therapy Department, were assessed for Piriformis Syndrome. Participants were assigned to either Group A (Experimental) or Group B (Control) based on predefined inclusion and exclusion criteria. The intervention lasted for 10 days. Participants underwent the assigned	Pain intensity was assessed using the Visual Analog Scale (VAS), and functional disability was evaluated using the Modified Oswestry Disability Questionnaire (MODQ).	After 10 treatment sessions, a significant difference was observed between the groups in terms of pain reduction, improvement in hip internal rotation range of motion (ROM), and functional disability scores

				treatments, and their progress was monitored throughout the intervention period.		
2018[29]	To compare the effectiveness of Reciprocal Inhibition and Post-Isometric Relaxation Muscle Energy Techniques (MET) in individuals with Piriformis Syndrome.	Comparative Experimental	64 participants, aged between 25 and 45 years	Participants were randomly assigned to one of three groups: **Group A (n=15):** Received Reciprocal Inhibition technique. **Group B (n=15):** Underwent Post-Isometric Relaxation technique. **Group C:** Followed a conventional intervention approach. The treatment was administered over 12 sessions within a two-week period.	Pain intensity was assessed using the Visual Analog Scale (VAS), hip internal rotation (IR) range of motion (ROM) was measured, and functional ability was evaluated using the Lower Extremity Functional Scale (LEFS).	After 12 treatment sessions, a significant difference was found between the groups in terms of pain reduction, improvement in hip IR ROM, and functional disability scores.
2018[30]	Comparing Cross Friction Massage and Stretching Exercises in Reducing Pain and Disability in Piriformis Syndrome Patients	Comparative Experimental	47 individuals aged 20-60 years	A randomized controlled trial was conducted from 2017-2018 using a non-probability sampling technique. Participants with a positive FAIR test and mild to moderate ODI levels were selected. Two groups were formed: Conducted in the Physiotherapy Department of ACS Medical College & Hospital using a pre-post intervention study design. Participants with gluteal pain and a positive Freiberg test were randomly divided into two groups. The intervention lasted for 14 sessions over two weeks, with each session lasting 10-15 minutes	VAS, ODI	Findings indicated that CFM was more effective than stretching in reducing pain and enhancing functional ability in individuals with Piriformis Syndrome.
2019[31]	Comparing MET and Stretching in Piriformis Syndrome Patients Undergoing SWD Therapy	Comparative	A female patient with Age between 30-35		VAS,LEFS	MET combined with SWD therapy showed a significantly greater improvement compared to stretching exercises with SWD.
2020[32]	Effectiveness of MET Combined with DFM on Pain, Disability, and Hip IR ROM in Piriformis Syndrome.	Experimental	30 individuals aged 25-48 years		ODI,VAS,ROM	Participants in the MET + DFM group showed greater improvement in pain relief, functional disability reduction, and internal hip rotation ROM compared to the control group.
2021[33]		Experimental	40 individuals aged 19 and above		VAS	

2023[34]	Examining the Impact of INIT with Integrated RRAF vs. PRT in Managing Piriformis Syndrome	Comparative Experimental	40 individuals aged 20-40 years	After assessment, participants were divided into two groups: Group A (n=15): Received Ultrasound and Piriformis Muscle Stretching Group B (n=15): Underwent MET combined with DFM Each session lasted 30-40 minutes, six days a week.	NPRS ,ROM,ODI	INIT was found to be more effective than PRT in managing symptoms of Piriformis Syndrome
2024[35]	Comparing Positional Release Therapy and Deep Transverse Friction Massage for Mechanical Low Back Pain	Experimental	20 individuals		VAS	Both treatments significantly reduced lumbar pain and disability while improving lumbar ROM.
2024[36]	Effectiveness of Ultrasound Combined with Stretching in Managing Piriformis Syndrome	Experimental	30 individuals Age 20-50 years 25-year-old female	Participants were randomly assigned to two groups: Group A: INIT (Integrated Neuromuscular Inhibition Technique) Group B: PRT (Positional Release Therapy) Each group received two treatment sessions per week for eight weeks	NPRS, ROM, LEFS	The combination of ultrasound therapy and stretching was found to be effective in alleviating pain in individuals with Piriformis Syndrome.
2025[37]	This study aims to evaluate the effectiveness of Muscle Energy Technique with stretching in comparison to Myofascial Release Technique combined with strengthening, with both approaches supplemented by Transcutaneous Electrical Nerve Stimulation, in individuals experiencing Piriformis Syndrome."	Case Report		Participants were randomly assigned to two groups using a lottery method. Each had at least one trigger point in the iliopsoas muscle. Assessments were conducted at baseline, the 2nd week, and the 4th week.	NPRS, ROM, LEFS	MET with stretching may be more effective in alleviating pain, while MFR with strengthening appears to provide greater benefits in enhancing ROM, muscle strength, and functional performance.
	Case Study: Evaluating the Effect of MET on a Patient with Piriformis Syndrome			A pre-test and post-test design was used, with participants selected based on specific criteria using purposive sampling from September to October 2023. Participants were selected through appropriate screening based on predefined inclusion and exclusion criteria. They were then		Participants in the MET + DFM group showed greater improvement in pain relief, functional disability reduction, and internal hip rotation ROM compared to the control group. The patient demonstrated significant improvements in all outcome measures, including reduced pain, increased hip ROM, and better lower limb function

				allocated into two groups: Group A : MET with stretching and AROM exercises along with TENS Group B: MFR Technique with strengthening Exercises and AROM exercises with TENS. A six-week physiotherapy intervention, including MET along with conventional treatment (stretching, strengthening and moist heat application), was provided		

3. Discussion

The purpose of this systematic review was to analyzed the effectiveness of Muscle Energy Technique (MET) in patients with Piriformis Syndrome (PS), focusing on pain reduction, disability improvement, and increased internal rotation (IR) range of motion of the hip joint.

The present study aimed to evaluate the effectiveness of the Muscle Energy Technique (MET) in managing pain, disability, and limitations in internal rotation range of motion (ROM) of the hip joint in patients with piriformis syndrome. The results indicate that MET significantly reduces pain and disability while improving hip joint mobility, particularly in internal rotation. These findings align with previous studies that have demonstrated the benefits of MET in alleviating musculoskeletal dysfunctions by promoting muscle relaxation, enhancing circulation, and improving neuromuscular control.

The observed reduction in pain levels can be attributed to MET's ability to release muscle tension and improve blood flow, thereby reducing compression of the sciatic nerve by the piriformis muscle. The improvement in disability scores suggests that MET contributes to enhanced functional outcomes, allowing patients to perform daily activities with greater ease. Additionally, the significant increase in internal rotation ROM highlights MET's role in reducing muscle tightness and restoring joint mobility, which is crucial for individuals experiencing piriformis syndrome.

Comparing these findings with existing literature, MET appears to be an effective alternative or adjunct to conventional physiotherapy approaches such as stretching, myofascial release, and strengthening exercises. While stretching exercises alone have been shown to improve flexibility, MET offers the advantage of actively engaging the patient's muscles, leading to more sustainable improvements in mobility and pain reduction.

However, certain limitations must be considered. The study was conducted over a relatively short duration, and long-term effects of MET on piriformis syndrome remain uncertain. Additionally, the sample size was limited, and factors such as individual variations in muscle tightness and pain perception could have influenced the results. Future research with larger populations, longer follow-up periods, and comparisons with other physiotherapeutic interventions will help establish a more comprehensive understanding of MET's effectiveness in managing piriformis syndrome.

Despite these limitations, the study supports the use of MET as a safe and effective technique for addressing pain, disability, and restricted internal rotation ROM in patients with piriformis syndrome. Clinicians may consider incorporating MET into rehabilitation protocols to optimize patient outcomes and enhance mobility while minimizing discomfort.

However, certain limitations were observed across the studies. One major concern was the small sample sizes, which reduce the applicability of the findings to a larger population. Some limitations were noted across the studies. The variability in intervention protocols across studies also posed a challenge in drawing definitive conclusions. Moreover, most studies had short follow-up durations, making it difficult to assess the long-term effects of the treatments.

4. Conclusion

This systematic review supports the effectiveness of MET in the management of Piriformis Syndrome. The findings indicate that MET, particularly when combined with UST, provides significant improvements in pain relief, disability reduction, and increased IR ROM of the hip joint. These results highlight MET as a promising intervention for PS patients.

The findings of this study suggest that the Muscle Energy Technique (MET) is an effective intervention for patients with piriformis syndrome in reducing pain, improving functional ability, and increasing internal rotation range of motion (ROM) of the hip joint. Participants who underwent MET demonstrated significant improvements in pain relief, as measured by standardized pain assessment scales, and experienced enhanced mobility in daily activities. Additionally, the increase in hip joint internal rotation ROM indicates that MET effectively addresses muscle tightness and dysfunction associated with piriformis syndrome.

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