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Effectiveness Of Adding Muscle Energy Technique to Routine Physical Therapy for Pain Management, Range of Motion, and Functional Disability in Piriformis Syndrome

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ABSTRACT

Background of the study: Piriformis syndrome is a neuromuscular disorder. Muscle energy technique (MET), when combined with routine physical therapy, is proposed to improve outcomes by enhancing muscle flexibility, and reducing pain,

Methodology: A randomized controlled trial was conducted in the University of Lahore Teaching Hospital. In the routine physical therapy, 19 females and 12 males were allocated, while 20 females and 11 males were recruited in the other group. The control group received transcutaneous electric nerve stimulation (TENS), heat therapy, range of motion, stretching exercise and core strengthening exercise. At the same time, the experimental group was treated with the isometric relaxation muscle energy technique

Results: The muscle energy technique (MET) combined with routine physical therapy was more effective than routine physical therapy. Experimental group: After one-month follow-up, the value NPRS had a mean of 1.34±0.48, internal rotation ROM was 38.93± 4.78, abduction ROM was 39.83±5.84 and lower extremity functional scale was 67.38+12.31 while in control group, NPRS had value 2.3+0.31 ROM of internal rotation and abduction was 38.93±4.78 and 39.83±5.84, the mean value of lower extremity functional scale was 56.66±17.04.

Conclusion: Muscle energy technique and routine physical therapy are more effective in treating pain, range of motion, and functional disability.

Keywords: *Muscle energy technique, functional disability, range of motion, piriformis syndrome, pain, routine physical therapy.*

INTRODUCTION

Piriformis syndrome is a term used to describe a musculoskeletal condition caused by compression or irritation of the sciatic nerve. This terminology refers to musculoskeletal pain caused by the entrapment of the sciatica nerve by the inflammation of the piriformis muscle,

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causing buttock pain and pain along the entire route of the sciatica nerve[1]. The piriformis syndrome has also been classified regarding neuromuscular pathologies [2]. There is pain in the buttocks and hip, and it can also be referred to as lower back and thigh[2]. In other words, it is a pain in the gluteal region due to entrapment of sciatica nerve[3]. The piriformis muscle is one of the important muscles of the hip joint. It plays an important role during walking and weight-bearing activities[4].The individuals suffering from piriformis syndrome depict various degree of symptoms lasting from mild too severe[5]. The patient may experience pain, numbness, painful bowel movements, and difficulty performing the daily and basic activities of daily living, such as walking and stair climbing[5]. If the disease is not treated for long, it causes pain with prolonged sitting, standing and walking[6].The epidemiological estimate of piriformis syndrome varies. The piriformis accounts for about 9% of pain in the lower back and the posterior portion of the thigh. The incidence of piriformis syndrome is almost 3.4% every year[7]. There exists a gender difference for piriformis syndrome in individuals[8]. This syndrome occurs in male in old age whereas for females it is present in younger age. Moreover, a higher incidence is reported in females than in males. The leading causes of the disease in males and females are compression from a tumour and anatomic variations[9]. The correct history; and proper objective examination can help to demonstrate the exact cause of pain[10].Many diagnostic procedures can be used such as CT scan, MRI, and ultrasound for diagnosis degenerative disease, sacroiliac pain, and bursitis.[11]. Various treatment approaches have devised for the cure of this syndrome. This includes rest, medications like non-steroidal anti-inflammatory drugs (NSAIDs), opiates as well as muscle relaxants are the mainstays of treatment[12]. A physical therapy program appears to have promising outcomes in treating piriformis syndrome. It includes heat/cold therapy, ultrasound therapy, TENS, ultrasound massage and a stretching and strengthening program[13]. Physical therapy was considered an effective treatment for piriformis syndrome. The physical therapy treatment for piriformis includes management of trigger points, dry needling, acupuncture, overpressure and massage[14]. One supportive physical therapy treatment includes Muscle Energy Technique[15]. The muscle energy technique includes soft tissue manipulations, isometric, and sustained controlled isotonic exercises[16]. These exercises are designed to enhance the physiological mechanism and pain management. The patient considers muscle energy techniques forces in response to therapist force, resulting in maximal muscle contraction[17-19]. A descriptive study was conducted in order to highlight the prevalence of piriformis syndrome in Pakistan for individuals suffering from low back pain. Moreover, to evaluate a relationship between low back pain and piriformis syndrome. The results indicated that male to female ratio was 1:3.[11]. The prevalence of this disease is higher in females as compared to males[11]. Another study was carried out by Khakneshin et al. in 2021 to evaluate the importance and efficacy of different types of physiotherapy interventions. The study showed that when manual therapy was accompanied by stretching, a positive outcome appeared in response to the patient's signs and symptoms. Moreover, strong evidence exists for the muscle energy technique of stretching[20]. In piriformis syndrome (PS), a neuromuscular disorder, the piriformis muscle compresses the sciatic nerve, resulting in discomfort, limited range of motion (ROM), and functional impairment. It is important to have good treatment since it is frequently misunderstood or confused with other causes of sciatica. Although studies have been conducted on the immediate effects of the Muscle Energy Technique (MET) in treating acute and subacute instances of Piriformis Syndrome, little is known about the technique's long-term advantages. In particular, little research has been done on how long-term it affects pain, range of motion, and functional improvement. Thus, this research aims to investigate the long-term consequences of MET in addition to regular physical therapy (RPT) in individuals suffering from Piriformis Syndrome. This study aims to close the knowledge gap by assessing the long-term effects of MET on pain, mobility, and functional capacity. The findings will yield insightful information, giving medical practitioners greater alternatives when selecting the best course of action to improve patients' long-term outcomes. The study aims to improve the Quality of life for people with Piriformis Syndrome by

identifying the long-term advantages of MET on pain reduction, range of motion, and functional abilities. Clinicians can better customize treatment methods to individual patients by better understanding the long-term consequences of metformin. This might result in greater therapy outcomes and better care techniques. The study will increase knowledge about the possible advantages of MET among patients and doctors, encouraging more research and application of this method in physical therapy settings. The objective of this study is to compare the effects of muscle energy technique along with routine physical therapy on pain, range of motion and functional disability in patients having piriformis syndrome.

METHODOLOGY

This was a randomized controlled trial completed nine months from 1st March 2021 to 1st December 2021. It was conducted in the Physical Therapy Department of the University Physical Therapy and Rehabilitation Clinic, University of Lahore Teaching Hospital.

Inclusion criteria	Exclusion criteria
Individuals from the age group 25-45 years	The individuals having any pathology or recent injury of the lower extremity
Diagnosed patients of piriformis syndrome	Lumbar Radiculopathy
Both males and females	Any systematic dieses
Unilateral involvement of piriformis muscle.	Sacroiliac joint disorder and fracture of lower extremity

Table 1. Inclusion & Exclusion Criteria

Sample size was calculated using G-power version 3.1.9.2 software by putting values from previous study[20] with the study power of 0.80 and error margin of 5% by taking mean score of NPRS as outcome measure. After considering a 10% attrition rate, 31 participants in each group were recruited out of 62 participants. Out of 62 participants, 19 were females and 12 were males in the routine physical therapy group, and routine physical therapy plus muscle energy technique were 20 females and 11 males.

Data was collected by giving an informed signed consent. Subjects were divided randomly into two equal groups using a lottery method of randomization using computer-generated number**s.** The study was a single masked study. Data was collected at baseline, 4th, 8th, and 12th sessions and followed up after one month. The data was collected by using a well-developed questionnaire. The following individuals were included in the study.

- **Control group**
  Thirty-one participants fulfilling the inclusion criteria received conventional interventions like piriformis stretching, hip abductor strengthening, and moist heat (30 minutes/session) lasting 12 sessions on alternate days (3 sessions/week).
- **Experimental group**
  Thirty-one participants fulfilling the inclusion criteria received MET (Post-isometric relaxation) and conventional physical therapy (hip abductor strengthening, moist heat, as well as piriformis stretching) for 45 minutes/session lasting for 12 sessions on alternate days (3 sessions/week). Variables of the study was pain and functional disability of lower extremity Range of motion of hip joint (abduction and internal rotation).

The data was measured using goniometer for range of motion, NPRS for pain and LEFS (lower extremity functional scale)[21] for functional disability.

Data was analyzed in SPSS version 22. The numerical data was presented in mean ±S.D. The Kolmogorov-Smirnov test was applied to assess the normality of data. The data was generally distributed, so the parametric test was applied. Moreover, the group's comparison before and after treatment was done with the help of one-way ANOVA. Its value of less than 0.05 was considered significant.

RESULTS

The mean age of the control (RPT) group participants was 39.29±11.61, and of the experimental group (METS) was 37.61±12.15. Out of 62 participants, 19 were females and 12 were males in the routine physical therapy group, and routine physical therapy plus muscle energy technique were 20 females and 11 males. The P value of baseline NPRS = 1.00, baseline ROM 1.00 and 1.00 for internal rotation and abduction, respectively and baseline LEFS = 0.607; the data was normally distributed. Comparison of both groups showed significant improvement in LEFS, RPT, NPRS and Quality of life after treatment. The experimental group showed significant improvement in LEFS ($p<0.00$), NPRS ($p<0.000$) and Baseline ROM and values comparison of variables within groups showed significant improvement in low back pain, NPRS and Owestry disability index and Quality of life. The result of the experimental group: the value of baseline NPRS had means ± std. 2.93±0.24, ROM of internal rotation was 21.48±7.28, abduction 31.54±12.25 and baseline LEFS was 31.61±13.04. Whereas in the control group, the baseline NPRS had a Mean ± SD of 2.96±0.17, ROM of internal rotation was 21.54±7.15, abduction 31.54±12.25 and baseline LEFS was 32.48±12.52.In the experimental group, after one month the value NPRS had a mean of 1.34±0.48, internal rotation ROM was 38.93± 4.78, abduction ROM was 39.83±5.84 and LEFS was 67.38+12.31, while in control group, after moth follow up, NPRS had value 2.3+0.31 ROM of internal rotation and abduction was 38.93±4.78 and 39.83±5.84, the mean value of LEFS was 56.66±17.04.

Variables	Control Group (Mean±SD)	Experimental Group (Mean±SD)
Pain Baseline	2.9677 ± .17961	2.9355±.24973
Pain12session	2.8710± .34078	2.4194±.50161
Pain1month	2.0323± .31452	1.3548±.50161
ROM baseline internal Rotation	21.548±7.15001	21.4839±7.28867
RPM baseline Abduction	31.5484± 12.25789	31.5484±12.25789
ROM12 I R	29.3871± 6.75118	29.3871±6.75118
ROM 12 Abduction	35.9677± 9.07555	35.9677±9.07555
ROM 1 month I R	38.9355± 4.78843	38.9355±4.78843
ROM 1month abduction	39.8387± 5.84293	39.8387±5.84293
LEFS baseline	32.4839± 12.52962	36.6129±13.04525
LEFS12session	42.2581± 14.56701	51.9355±11.67029
LEFS 1 month	56.0645± 17.04687	67.3871±12.30901

Table 2: Descriptive statistics of the Control group and experimental group (N=31)

Comparing the experimental group to the control group, there was a notable decrease in pain and increased functional scores overall. While the LEFS increased from 31.61 to 67.38, the NPRS fell from 2.93 to 1.34. Although not as dramatic as those seen in the experimental group, the control group did exhibit some improvement in pain levels (from 2.96 to 2.30) and functional outcomes (LEFS improved from 32.48 to 56.66). At follow-up, both groups' internal rotation and abduction ROM measures were comparable. So alternative hypothesis is accepted.

Variable	P value
Baseline NPRS	0.56
12th Session NPRS	0.00
1 Month follow-up NPRS	0.00
Baseline ROM Internal Rotation	.472
12th Session ROM Internal Rotation	.000
1 Month ROM Internal Rotation	.000
Baseline ROM Abduction	.000
12th Session ROM Abduction	.000
1 Month ROM Abduction	.000
Baseline LEFS	.209
12th Session LEFS	.005
1 Month LEFS	.004

Table 3. One-way ANOVA between two groups (N=62)

As the p-value is less than 0.05, it shows that the muscle energy technique is much more effective than routine physical therapy in improving the patient's pain, range of motion as well as functional disability.so an alternative hypothesis is accepted.

DISCUSSION

The present study's findings were corroborated by a study carried out by Velappanchavadi in 2019, which aimed to determine the efficacy of muscle energy techniques in treating piriformis syndrome. The study evaluated that muscle energy technique significantly improved pain measured through the visual analogue scale as well as functional status in individuals with piriformis syndrome compared to stretching interventions. Moreover, a study conducted by N. Ilyas and A. Jamil in 2020 explored the effects of active release therapy (ART) and hold-relax with agonist contraction (HRAC) on pain, functional disability, and sleep quality in patients with piriformis syndrome. The findings demonstrated that active release therapy was more effective in reducing pain and functional impairment, while no significant difference in sleep quality was observed between the two approaches[22,23].

Similarly, a study by Rajendran and Sundaram in 2018 evaluated the effectiveness of reciprocal inhibition and post-isometric relaxation in patients with piriformis syndrome. The study incorporated muscle energy techniques and conventional physical therapy and concluded that

reciprocal inhibition and isometric contraction significantly improved pain and hip range of motion, particularly in external and internal rotation. The findings of this study align with the present study results due to the use of similar variables and outcome tools[24].

In 2016, Anjali conducted a study that compared the impact of friction massage and muscle energy techniques on pain, functional disability, and internal range of motion in patients with piriformis syndrome. The findings indicated that muscle energy techniques significantly improved pain, range of motion, and functional disability, aligning with the present study's findings[25]. Additionally, a systematic review conducted by F. Craml in 2015 assessed non-surgical approaches for managing piriformis syndrome. The review found strong evidence supporting botulinum toxin injections and moderate evidence supporting stretching and friction massage. However, these findings are in contrast to the present study's results[26,27].

Limitations

A small sample size may limit the findings' ability to be generalized. A more significant cohort could yield more reliable data and support the findings. Individual participant adherence to the treatment plan may impact how well the therapies work.

CONCLUSION

The muscle energy technique and routine physical therapy are much more effective than routine physical therapy in improving pain, range of motion, and functional disability in Piriformis Syndrome.

Recommendations

Standardized methods for both conventional physical therapy and MET might reduce variability and increase the dependability of the outcomes. The controlled setting and the involvement of licensed therapists may assist in lessening treatment delivery variability. Incorporating instructional elements for participants concerning lifestyle adjustments and self-management techniques might enhance overall results and treatment plan compliance.

AUTHORS' CONTRIBUTION:

The following authors have made substantial contributions to the manuscript:
Conception or Design: Hafiz Muhammad Bilal Hanif, Muhammad Waqar Afzal
Acquisition, Analysis or Interpretation of Data: Hafiz Muhammad Bilal Hanif, Ahsan Illyas, Sana Akram, Maryam Naeem.
Manuscript Writing & Approval: Mehak Hamna Zahra Gilani

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