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Comparative Effects of Post-Isometric Relaxation Technique and Strain Counterstrain in Patients with Piriformis Syndrome

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DECLARATIONS

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ABSTRACT

Background: Piriformis syndrome is a neuromuscular disorder causing pain and mobility limitations due to sciatic nerve compression. This study compares post-isometric relaxation and strain counterstrain techniques to determine which approach provides superior pain relief, mobility improvement, and functional recovery in affected patients. **Objective:** To evaluate the comparative effects of the post-isometric relaxation technique and strain counterstrain in patients with piriformis syndrome. **Methodology:** Single-blinded, randomised clinical trial with clinical trial ID No. IRCT2024718062453N1 was conducted. Participants were selected from the outdoor patient department of Allied Hospital, National Hospital, Faisalabad, from February to June 2024. The study included 66 participants using convenient sampling, both male and female, between the ages of 30-50 years. Group A received post-isometric relaxation therapy while Group B received strain counterstrain therapy three times a week for four consecutive weeks. Both groups also received conventional therapy, which included the application of a hot pack to the gluteal area for 15 minutes. Pain was assessed by the Numeric Pain Rating Scale, while hip abduction and internal rotation range of motion were measured through a universal goniometer and functional activity was assessed by the Lower Extremity Functional Scale before and after four weeks of treatment. Within and between-group analysis of pain and range of motion was done using the Wilcoxon Signed-Rank and Mann-Whitney U tests respectively. **Results:** Overall, the findings of the randomized clinical research highlight the advantages of post-isometric relaxation against strain counterstrain in the treatment of piriformis syndrome. Patients who had post-isometric relaxation treatment showed significant decreases in pain, increased range of motion, and reduced impairment ($p<0.05$). **Conclusion:** Post-isometric relaxation demonstrated superior efficacy in reducing pain, improving range of motion, and enhancing functional recovery in patients with piriformis syndrome compared to strain counterstrain. These findings support post-isometric relaxation as an effective therapeutic approach for managing musculoskeletal impairments associated with piriformis syndrome.

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INTRODUCTION

The neuromuscular disorder known as piriformis syndrome (PS) is characterized by discomfort not only in the hips and buttocks but also has the potential to cause pain that radiates in the lower back region and thigh.[1,2] This disorder can be defined by the spasm of the piriformis muscle, which in turn irritates the sciatic nerve. However, this creates discomfort in the area of the buttocks, and it may even result in pain that is transmitted to the lower back and the thigh. As a result of the fact that patients often report experiencing discomfort deep into the hip and buttock, piriformis syndrome is also often known as "deep buttock syndrome." The majority of the time, piriformis syndrome is brought on by a shortening or tightening of the piriformis muscle. Although several factors may be ascribed to this, they can all be grouped into two major categories: overload (or training faults) and biomechanical inefficiency.[3]

Piriformis syndrome may be caused by a variety of abnormalities, including shortening, spasm, hypertrophy, or inflammation of the piriformis muscle, as well as any anatomical variations of the piriformis that lead to compression of the sciatic nerve.[4,5] The frequency of PS is 6% in the general population, and the majority of those affected are females.[6] It is estimated that between 5 and 36 percent of persons who suffer from low back pain have a PS.[4,5] There is a six-to-one ratio between the prevalence of PS in women and males, which may be attributable to the fact that females have a broader Q-angle than males.[6] The incidence of piriformis syndrome in people with persistent low back pain is reported to be 17.2%. The prevalence ranges significantly from 6 to 36% according to the criteria for diagnosis used and the characteristics of the sample individuals.

It is primarily seen in people who are in the middle age range.[7] PS is responsible for 6-8% of instances of sciatica and have many symptoms, one of which is discomfort that radiates down the lower leg. Most of the time, PFS is responsible for a large decrease in the internal hip rotation, which ultimately results in the hip joint staying in the external rotation position even when the patient is in a resting posture.[8] As a result of the piriformis syndrome, functional asymmetries of the lower limb are usually noted. This condition is thus frequently misinterpreted as sacroiliac joint block. It is difficult to move about while experiencing symptoms that are associated with the efficacy of the positional release technique as an indirect osteopathic manipulative therapy for persons with PS has been studied. This method entails identifying active trigger sites and then applying ischemia compression to elicit the nociceptive response. Next, the limb is adjusted to alleviate the strain on the afflicted muscle, leading to the deactivation of the painful trigger points.[9]

Hou et al.[10] offered a theory to explain the benefits of ischemia compression. They indicated that pain alleviation and muscular spasm reduction caused by direct digital pressure may be due to reactive hyperemia in the region or the spinal reflex mechanism. The strain counterstrain method (SCS) is well-recognized for its great effectiveness in alleviating pain and restoring functionality to muscles, bones, and joints. This technique is quite effective in treating back pain. The utilization of the positional release technique for somatic dysfunction necessitates the initial palpation of a sensitive area in the soft tissues. Subsequently, the patient's limb is manipulated in a manner that alleviates at least 70% of the pain caused by pressure on the sensitive area, thereby identifying a position of comfort. It is recommended to maintain this position of comfort for a minimum duration of 90 seconds. The therapeutic alterations achieved by positional release include both proprioceptive and nociceptive processes, which are theorized to be a result of the shortening or "folding-over" of aberrant tissue.[11]

Strain counterstrain or positional release method, involves moving aberrant joints and their associated muscles away from their restrictive barrier and into a more relaxed posture. The SCS technique is a non-active method used to alleviate musculoskeletal discomfort by inducing relaxation in shortened tissues. The originator of this approach was Jones in 1981, and the precise physiological mechanism remains unidentified. Contracted and painful tissues may be positioned softly, and if this pleasant posture is maintained for over one minute, it can stimulate the activation of the Golgi tendon organ, which promotes relaxation of the tense and constricted muscle.[12] SCS is a beneficial approach for alleviating pain in the treatment of sensitive points by applying mechanical pressure to the key tender points.[12] SCS is seen as an optimal option for developing patient trust since it involves holding the patient in a pain-free posture in a passive manner. SCS may alleviate discomfort in patients who have

suffered pain during an intervention session by using alternative manual therapy methods, such as manipulation and MET (muscle energy technique), or particular core stability exercises to improve the forced closure of the sacroiliac joint.[13]

SCS facilitates the normalization of muscle tone in tight muscles associated with dysfunction in the SIJ, leading to a notable enhancement in the activation of weak muscles, particularly the gluteal group. The efficacy of SCS has been shown in alleviating pain or discomfort upon palpation in several musculoskeletal conditions, including acute or chronic low back pain, mechanical pain in the neck, and masseter trigger points. SCS, or spinal cord stimulation, enhances local circulation, leading to increased food supply, elimination of metabolic waste, and the reversal of ischemia. This reversal may result in the presence of painful tender points or sustained dysfunction.[13]

METHODOLOGY

Single-blinded, randomised clinical trial with clinical trial ID No. IRCT2024718062453N1 was conducted. Participants were selected from the outdoor patient department of Allied Hospital, National Hospital, Faisalabad, from February to June 2024. The study included 66 participants using convenient sampling, both male and female, between the ages of 30-50 years. Subjects were randomly allocated into two groups through the lottery method. Subjects who met the selection criteria after signing the consent form were randomly allocated into two groups i.e., Group A and Group B, by lottery method.

Group A received post-isometric relaxation therapy while Group B received strain counterstrain therapy three times a week for four consecutive weeks. Both groups also received conventional therapy, which included the application of a hot pack to the gluteal area for 15 minutes. The piriformis muscle was stretched with a 30-second duration, followed by a rest period of five seconds, and three sets were performed. The hip abductor muscles were strengthened while lying on the side, with 10 repetitions each set and a total of three sets.[4,7] Pain was assessed by the Numeric Pain Rating Scale (NPRS), while hip abduction and internal rotation range of motion were measured through a universal goniometer and functional activity was assessed by the Lower Extremity Functional Scale (LEFS) before and after four weeks of treatment.

All the data were analyzed using SPSS version 23. For the quantitative variables, the mean and standard deviation were determined (age, gender). The assumption of normality of the data was assessed using the Shapiro-Wilk test. For the NPRS variable, the data were not normally distributed, so a non-parametric test was applied. For the other variables, the data were normally distributed; therefore, a parametric test was used for statistical analysis. Within and between-group analysis of pain and range of motion was done using the Wilcoxon Signed-Rank and Mann-Whitney U tests respectively.

A data collection letter was obtained from the university, and consent was also obtained from the head of the physical therapy department. Consent was secured from the patients, particularly through the assurance that their data would only be used for research purposes. A description of the study was provided to patients before they consented. Provision of all information to the patients was effectively made regarding this study, including the benefits of the treatment and the fact that there would be no harm to them from this treatment.

RESULTS

The mean and standard deviation of age along with frequency and percentages of gender given in Table 1. Within and between-group analysis of NPRS using the Wilcoxon Signed-Rank and Mann-Whitney U test respectively, demonstrated in Table 2. Within and between-group analysis of other variables is demonstrated in Table 3. Overall, the findings of the randomized clinical research highlight the advantages of post-isometric relaxation against strain counterstain in the treatment of piriformis syndrome. Patients who had post-isometric relaxation treatment

Table 1: Characteristics of participants (n=33)

Variables		Group A	Group B
Age	Years	37.00±4.37	37.88±5.16
Gender	Male	14 (42.4%)	16(48.5%)
	Female	19 (57.6 %)	17 (51.5%)

Table 2: Within and between-group analysis of NPRS (n=33)

Variables		Group A		Group B		
		Mean Rank	Sum of Ranks	Mean Rank	Sum of Ranks	p-value
Wilcoxon Signed-Rank test	Pre-NPRS	16.50	528.00	16.50	528.00	0.00
	Post-NPRS	16.50	528.00	16.50	528.00	0.00
Mann-Whitney U Test	Pre-NPRS	37.98	1253.50	29.02	957.50	0.00
	Post-NPRS	26.92	861.50	38.08	1218.50	

Table 3: Within-group analysis of variables

Variables	Group A		Group B		p-value
	Mean	Std. Deviation	Mean	Std. Deviation	
Pre-Abduction	18.96	1.05	19.42	0.98	0.00
Post-Abduction	35.55	1.08	30.91	1.07	
Pre-Internal	14.74	1.17	14.80	1.24	0.00
Post-Internal	39.96	0.64	34.26	1.51	
Pre-LEFS	8.00	4.39	7.25	4.29	0.00
Post-LEFS	70.87	1.77	60.53	3.11	

Table 4: Between-group analysis of variables

Variables	Group A		Group B		p-value
	Mean	Std. Deviation	Mean	Std. Deviation	
Pre-Abduction	18.99	1.05	19.46	0.98	0.00
Post-Abduction	35.55	1.08	30.91	1.07	
Pre-Internal	14.77	1.16	14.85	1.27	0.00
Post-Internal	39.96	0.64	34.26	1.51	
Pre-LEFS	7.78	4.49	7.06	4.36	0.00
Post-LEFS	70.87	1.77	60.53	3.11	

showed significant decreases in pain, better range of motion, and reduced impairment ($p<0.05$).

DISCUSSION

Piriformis Syndrome is known as a neuromuscular disorder that causes discomfort, tingling, or loss of sensation in the buttocks and along the course of the sciatic nerve. This ailment is often worsened by extended periods of sitting or direct compression of the piriformis muscle.[14] The PIR approach involves activating the afflicted muscle via a post-isometric contraction and then performing a passive stretch. This process is believed to improve muscular relaxation and increase muscle length.[15] This mechanism might perhaps account for the higher results found in pain alleviation and functional enhancement. However, it is possible that SCS, which involves placing the muscle in a contracted condition to relieve tension[16], may not lead to the same level of muscular and neurological changes needed for a significant reduction in PS symptoms as compared to PIR ($p<0.05$).[7] Both studies provide evidence that PIR is an effective method for reducing discomfort, improving hip abduction and internal rotation, and reducing functional impairment in individuals diagnosed with PS. They indicate enhancements in the extent of movement and a decrease in functional disability, underscoring the efficacy of PIR in reinstating regular muscle function and enhancing patients' quality of life.

To summarise, both the research conducted by Nambi and Dusad[4], Rehman, Khan[7,] and the present research provides compelling data supporting the efficacy of PIR in controlling PS. Specifically, PIR has been shown to effectively reduce pain, improve hip mobility, and enhance functional results. The comparison of the comparable procedures further emphasizes PIR's better effectiveness, indicating that PIR might be an effective approach for treating PS, as both passive and other active treatments showed that MET was more effective than SCS in alleviating functional impairment. The outcomes of this research support the notion that PIR is a more effective treatment for PS compared to SCS. The consistent finding in this research is that active approaches (MET and PIR) outperform the more passive SCS. The study emphasizes that while SCS may provide therapeutic advantages, actively involving muscles via methods like MET often leads to superior results in terms of enhancing functionality and alleviating discomfort. [11]

A study investigated the effectiveness of stretching and PIR (post-isometric relaxation) as a type of muscular energy therapy in reducing piriformis muscle stiffness and improving symptoms associated with PS. Their results demonstrate the efficacy of PIR and support the findings of the current study. Furthermore, Deshmukh et al. highlights PIR's long-term benefits, indicating that it may help people with PS continue to have symptom relief.[12] This is consistent with the findings of the present research, which observed that PIR provides both immediate and long-lasting relief. These results further support the idea that PIR is a preferable strategy for managing PS. Another study examined the impact of a program designed to improve the gluteal muscles of individuals suffering from PS. Their research revealed that individuals who engaged in the gluteal training program, consisting of abductor strengthening exercises, showed substantial enhancements in pain alleviation, augmented strength, and improved lateral rotation. These findings indicate that enhancing the gluteal muscles may have a significant impact on reducing the symptoms of PS, emphasizing the significance of focused muscle training as a therapy strategy.[17]

Similarly, another researcher studied patients with piriformis syndrome to find out how stretching and strengthening the hip abductors improve functional limitation, and concluded that strengthening exercises provide efficient results in improving functionality of the lower extremity. When comparing the two, the present research highlights the effectiveness of PIR in controlling PS, specifically in lowering pain, increasing ABD and IR ROM, and decreasing disability, as opposed to SCS ($p<0.05$). Although Idrees, Khan[18] and Raza, Arslan[17] highlighted the advantages of muscle strengthening, the present research indicates that PIR may serve as a successful first therapy for PS.
The studies provide significant insights into the efficacy of different therapeutic strategies in the treatment of chronic low back pain and related diseases. Ahmed et al. conducted a study to examine the impact of SCS on chronic low back pain.[12,19]

The results showed that SCS had a substantial positive influence on pain reduction, range of motion, and overall functional status. This emphasizes the capacity of SCS to improve the quality of life for persons with chronic low back pain by treating both the sensation of pain and the restrictions in physical function. A study investigated the effects of combining the positional release technique on sensory nerve conduction velocity in individuals suffering from low back pain and sciatica. Their research uncovered that using this integrated method may substantially augment the functionality of the sciatic nerve, resulting in supplementary alleviation of pain and enhancement of nerve function for those suffering from low back pain accompanied by sciatica.[19]

Ahmed, Anwar[12,] and Abdallah[19] emphasize the advantages of SCS or positional release techniques for persistent low back pain and sciatica. The present research emphasizes the better results of PIR for piriformis syndrome. This indicates that the efficiency of various treatments varies depending on the particular musculoskeletal issue being addressed, with subtle differences in their outcomes. Therefore, whereas SCS or positional release approaches might be beneficial for chronic low back pain and sciatica the present research indicates that PIR may provide even larger advantages for PS.[20] This is because PIR is particularly effective in lowering muscle tension and enhancing flexibility, which are crucial in addressing PS. By combining these discoveries, it becomes clear that a customized strategy for managing musculoskeletal pain is crucial. For example, by combining active techniques like PIR for pelvic stabilization with passive methods like

SCS and positional release for disorders like low back pain and sciatica, it is possible to enhance patient results. This strategy leverages the unique characteristics of each therapy modality to successfully address particular clinical demands.

CONCLUSION

Overall, the findings of this randomized clinical trial highlight the advantages of post-isometric relaxation against strain counterstrain in the treatment of piriformis syndrome. Patients who had post-isometric relaxation showed significant decreases in pain, better range of motion, and reduced impairment. These findings suggest that post-isometric relaxation may be favorable and effective management for piriformis syndrome.

DECLARATIONS

Consent to participate: Written consent had been obtained from patients. All methods were performed following the relevant guidelines and regulations.

Availability of data and materials: Data will be available on request. The corresponding author will submit all dataset files.

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CONSORT Guidelines: All methods were performed following the relevant guidelines and regulations.

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