



COMPARATIVE EFFECTS OF THE POST-FACILITATION STRETCHING TECHNIQUE VERSUS THE ACTIVE RELEASE TECHNIQUE ON PAIN AND LOWER-EXTREMITY FUNCTION IN ADULTS WITH PIRIFORMIS SYNDROME

Original Research Article

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ABSTRACT

Background: Piriformis syndrome (PS) is characterized by pain resulting from the compression of the sciatic nerve by the piriformis muscle. The aim of this study is to compare the effectiveness of the post-facilitation stretching technique (PFST) and active release technique (ART) in the management of patients with PS. **Methods:** A comparative study involving two groups was conducted at Dr. M.G.R. Educational and Research Institute, Chennai. Thirty adults aged between 20 and 30 years with a clinical diagnosis of PS were recruited through simple random sampling into two groups (n = 15 per group). The treatment groups received PFST and ART, respectively, along with conventional physical therapy (moist heat and manual therapy). The participants underwent 24 sessions of treatment delivered three times a week over an eight-week period. Pain was measured on a 0-10 Numerical Pain Rating Scale (NPRS) and lower extremity function on the Lower Extremity Functional Scale (LEFS) before and after the treatment period. The data were analyzed using SPSS version 24; t-tests were used to compare the means within and between groups, and $p < 0.05$ was considered statistically significant. **Results:** The PS pain and functional assessment scales were comparable between the groups prior to treatment ($p > 0.05$). Both groups exhibited a significant reduction in the NPRS and an increase in the LEFS scores following treatment ($p \leq 0.001$). The changes in scores within the PFST and ART groups were as follows: the NPRS scores reduced from 5.00 to 2.80 and from 5.06 to 2.13, respectively, while the LEFS scores increased from 45.00 to 59.86 and from 44.73 to 63.40, respectively. The ART intervention was significantly better than the PFST intervention in the reduction of PS pain ($p \leq 0.001$) and improvement of lower extremity function ($p \leq 0.001$). **Conclusion:** Both PFST and ART lead to a significant reduction in PS pain and improvement in lower extremity function. However, ART exhibits significantly greater effectiveness compared with PFST in PS patients; thus, ART may be incorporated into the rehabilitation protocols for PS patients to relieve their symptoms.

Keywords: Piriformis syndrome; Active release technique; Post-facilitation stretching; Numerical Pain Rating Scale; Lower Extremity Functional Scale; Manual therapy



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INTRODUCTION

Piriformis syndrome (PS) is a neuromuscular disorder in which the sciatic nerve becomes compressed due to the piriformis muscle [1]. PS results in the presence of pain, tingling, and numbness in the legs that radiates from the buttocks [1]. The causes of PS include muscle tightness due to overexertion of the piriformis muscle or trauma to the buttocks [2]. Among the techniques used to treat piriformis syndrome are the post-facilitation stretching technique (PFST) and the active release technique (ART) [3]. PFST involves deep stretching after a maximal isometric contraction of the muscle. The use of post-isometric relaxation can lead to deep stretching that bypasses the reflexes of the muscles that make it difficult to extend the muscles deeply [4]. This technique allows for deep flexibility in the muscles and can relieve the tightness of the muscles; hence, it is effective in relieving the muscular dysfunction caused by PS [4, 5]. ART involves the manual release of adhesions within the muscles and tendons by a therapist; these adhesions are created due to muscle overexertion [6, 7, 8]. The therapist applies force to the muscles while the patient performs specific movements to allow the adhesions to break and restore the function of those muscles [6, 7, 8]. PS can be primary or secondary. In primary PS, the causes of the symptoms are the anatomical features of the body, such as the bifid piriformis muscle, the bifid sciatic nerve, and the anomalous course of the sciatic nerve [9]. In most cases, the primary form is seen in fewer than 15% of individuals with piriformis syndrome. In secondary PS, which is the most common form, the cause of the symptoms includes muscle inflammation, muscle hypertrophy, muscle ischemia, trauma to the piriformis muscle, and overexertion of the muscle [10]. The symptoms of PS include deep gluteal pain, pain with prolonged sitting or standing, pain with specific types of hip rotation movements, pain with lying on the affected buttocks, and pain with standing or walking for long periods of time [11]. PS is most common in individuals between the ages of 40 and 50 years of age, and more females than males are affected by the condition [11]. The prevalence of PS is between 0.3% and 36% of individuals with low back pain that radiates to the leg, and PS is present in 17.2% of individuals with chronic low back pain [12]. PS is common among athletes and individuals who are required to sit for long periods of time [13, 14]. The diagnosis of PS is made clinically by the doctor during the physical examination of the patient and during specific tests like the FAIR test [15].

Imaging tests like MRI and CT scans are performed to rule out other causes of low back pain like disc herniation, arthritis, vertebral fractures, and tumours [16]. The treatment options for PS include surgical and non-surgical options. Surgical interventions include piriformis muscle release and sciatic nerve decompression procedures [17]. Non-surgical treatments include physiotherapy, exercise, pain killers like NSAIDs, muscle relaxants, and neuropathic painkillers [18]. Other treatments include cold and heat applications to the affected area, botulinum toxin injections, and corticosteroid injections into the sciatic nerve [19]. PFST is one form of the muscle energy technique (MET). The MET is a manual therapy procedure in which the muscles are stretched after performing a maximal isometric contraction of the muscle [20]. The muscle energy technique has been shown to have greater effectiveness in increasing flexibility compared to self-stretching techniques. Studies have also demonstrated that the muscle energy technique is more effective than post-isometric relaxation methods in reducing hamstring tightness. The muscle energy technique has also been demonstrated to be effective in reducing the pain and disability associated with low back pain. ART has been demonstrated to be effective in treating soft tissue disorders like carpal tunnel syndrome, Achilles tendinopathy, and lateral epicondylitis. Additionally, ART has been shown to improve the range of motion and pain levels in patients with shoulder and neck conditions. Therefore, there is a lack of studies that compare the effectiveness of the PFST and ART for treating PS. Hence, the study was undertaken to determine which of these two manual therapy techniques is more effective in managing the pain caused by PS and improving the function of the lower extremities of PS patients.

METHODS

Study Design and Setting

The methodology of this study employed to evaluate the effectiveness of the Active Release Technique (ART) and the Post-Facilitation Stretching Technique (PFST) involved the design of a study that compared the outcomes of Group A that received ART with those of Group B that received PFST. This study was conducted in the Outpatient Department of the Faculty of Physiotherapy, Dr. M.G.R. Educational and Research Institute, Velappanchavadi, Chennai, India. The study was conducted over a total period of six months (24 weeks).

Sample size and sampling method

Thirty (30) participants who fulfilled the eligibility criteria were recruited into the study. Simple random sampling was employed to group the participants into Group A and Group B, each containing fifteen participants. Both male and female participants who were within the age range of 20 to 30 years were included in the study.

Randomization and ethical considerations

Approval was obtained from the Institutional Review Board to conduct the study. The participants who were eligible were randomly allocated into Group A and Group B using the lottery method. All participants who were to take part in the study were made aware of the nature and duration of the study. Informed consent was obtained from each participant prior to their enrolment into the study. Pre-evaluations of all participants were conducted to assess their demographics, medical history, personal history, pain levels, and posture.

Participants

Adults who presented themselves at the Outpatient Department with a diagnosis of piriformis syndrome were screened for eligibility for participation in the study. The participants were required to meet the following criteria.

Inclusion Criteria

- Male and female participants
- Aged between 20 and 30 years
- Presenting with positive clinical symptoms of piriformis syndrome
- Decreased range of motion of the hip
- Experiencing chronic pain in the hip or gluteal region

- Experiencing tenderness in the sciatic foramen
- Subjects with a positive response to the piriformis test

Exclusion Criteria

- Recently undergone surgical procedures
- Currently suffering from malignancy
- Subjects with rheumatoid arthritis
- Subjects with disc pathology
- Presenting with a systemic disorder
- Pregnancy
- Femoral or intervertebral fracture; hip dislocation
- Stroke or amputation

Intervention protocol

Both Group A and Group B participants received conventional therapy in addition to the manual therapy that was delivered to each group. Conventional therapy consisted of applying a moist hot pack over the gluteal region for 10 minutes followed by manual therapy for 20 minutes. The total length of each session was approximately 30 minutes and the participants had three sessions per week for eight weeks (24 sessions in total).

Group A - Post-Facilitation Stretching Technique (PFST). This technique involved the positioning of the limb of the patient in more than 60° of flexion with slight adduction and external rotation when supine. The therapist positioned the limb of the patient and brought the piriformis to its mid-range position. The patient was asked to perform a contraction in external rotation to a maximal effort for 7-10 seconds. The patient was then deep deeply stretched in the position and rested. The process was repeated five times per session.

Group B - Active Release Technique (ART). With the patient lying on their prone position, the therapist palpated the piriformis muscle to locate areas of restriction and applied pressure with the elbow over the restricted area. The patient was made to move their limb to take the muscle to its lengthened position. This maneuver was performed three to five times per session.

Home programme

Both groups were taught a home programme that consisted of the following exercises to be performed at home: the supine piriformis stretch (20 to 30 seconds, three to five repetitions); the clamshell exercise (two to three sets of ten to fifteen repetitions); and prone hip external rotation / frog-leg lifts (two to three sets of eight to twelve repetitions).

Outcome measures

Pain was measured with the **Numerical Pain Rating Scale (NPRS)**. The NPRS is an 11 point self administered scale for reporting the intensity of pain where 0 = no pain and 10 = worst imaginable pain. The patient is requested to indicate the level of pain by choosing a number from the scale that matches the intensity of current pain. The NPRS has proven effective, reliable and valid for measuring pain intensity. The scale is commonly used in musculoskeletal and rehabilitation studies due to its simplicity in administration and scoring [21].

Lower extremity function was measured with the **Lower Extremity Functional Scale (LEFS)**. The LEFS is a self administered 20 item scale that measures a patient's performance of activities of daily living with the lower extremities including running, stair climbing and walking. Each item is rated from 0 to 4 where 0 represents either unable to perform or extreme difficulty and 4 represents no difficulty. A total score is generated out of 80. Higher scores represent greater functional level and less disability. The LEFS has been found to have good internal consistency ($\alpha = 0.96$) and good test-retest reliability (ICC = 0.94). The scale has also been well established for use across a variety of musculoskeletal disorders in the lower extremity [22].

Statistical analysis

Data from the study was tabulated and analysed using SPSS (Statistical Package for the Social Sciences) version 24. Data was presented in tables and figures. Outcomes were presented at a significance level of $p < 0.05$ and with 95% confidence interval. Data was first tested for normality using the Shapiro-Wilk test. As the dependent variables were normally distributed within each group, a parametric test was used to analyse the data. A paired t-test was used to determine the significance within each group between pre-test and post-test scores. An independent (unpaired) t-test was used to determine the significance between the two groups pre-test and post-test scores.

RESULTS

The baseline characteristics of the two groups were comparable with respect to each of the outcome variables ($p > 0.05$). Following the intervention, however, both groups exhibited statistically highly significant within-group differences in relation to both pain and function ($p \leq 0.001$). In Group A, NPRS scores decreased from a mean of 5.00 to 2.80 (a reduction of 2.20 points, or approximately 44% of the possible score), while LEFS scores increased from 45.00 to 59.86 (a gain of 14.86 points, or approximately 33% of the possible score). In Group B, NPRS scores decreased from a mean of 5.06 to 2.13 (a reduction of 2.93 points, or approximately 58% of the possible score), while LEFS scores increased from 44.73 to 63.40 (a gain of 18.67 points, or approximately 42% of the possible score) (Table 1 & 2). At the post-test measurement, therefore, there was a statistically significant difference between the two groups with regard to each of the two outcome variables ($p \leq 0.001$). Thus, each of the null hypotheses were rejected.

TABLE 1. BETWEEN-GROUP COMPARISON OF NPRS SCORES (PRE- AND POST-TEST)

Time	Grp A Mean	Grp A SD	Grp B Mean	Grp B SD	t	df	p
Pre-test	5.00	0.76	5.06	0.70	-0.250	28	0.105 (NS)
Post-test	2.80	0.86	2.13	0.74	-2.269	28	<0.001***

*Group A = PFST; Group B = ART. NS = not significant ($p > 0.05$); *** $p \leq 0.001$.*

TABLE 2. BETWEEN-GROUP COMPARISON OF LEFS SCORES (PRE- AND POST-TEST)

Time	Grp A Mean	Grp A SD	Grp B Mean	Grp B SD	t	df	p
Pre-test	45.00	3.66	44.73	3.10	0.215	28	0.831 (NS)
Post-test	59.86	4.24	63.40	3.13	-2.595	28	<0.001***

*Group A = PFST; Group B = ART. A higher LEFS score denotes better function. *** $p \leq 0.001$.*

DISCUSSION

Piriformis syndrome is a condition that is characterised by deep pain within the glutes that can radiate down the lower limb due to irritation of the sciatic nerve by the piriformis muscle [1]. The condition is thought to develop due to the normal anatomical relationships between the sciatic nerve and the piriformis muscle, but also potentially due to factors like overuse, trauma to the area, and even prolonged periods of sitting [1,11]. The diagnosis of piriformis syndrome is made through clinical examination of the patient, often through additional tests that are likely to provoke pain associated with the condition, as well as through imaging tests to rule out other potential causes of sciatic nerve irritation [1,11]. Within the present study, each of the fifteen participants in each of the two treatment groups underwent eight weeks of treatment of three sessions each per week. The Post-Facilitation Stretching Technique is a treatment that aims to relieve tightness and enhance the flexibility of the muscles that are often experiencing tightness in individuals with piriformis syndrome. The treatment involves performing a maximal isometric contraction of the muscles to be treated, followed by a stretch of the muscles to which the individual is applying pressure [3]. Both the Post-Facilitation Stretching Technique and the Active Release Technique have been evaluated for their effectiveness in treating the symptoms of piriformis syndrome. For instance, Shahzad et al. (2020) evaluated the two treatments for piriformis syndrome in patients with similar conditions. The authors found that both treatments led to a significant reduction in pain intensity, muscle length, straight-leg raise, and the LEFS score of the patients with piriformis syndrome; however, the group that received the post-facilitation stretching technique experienced the most improvement in each of these measures [4]. The Active Release Technique is a treatment that targets the soft tissues of the body to release adhesions and scar tissue that can form within individuals with conditions like piriformis syndrome. These treatments involve a manual therapist applying tension to the affected tissue while the patient performs movements that actively work the affected muscles [5,7,15].

Additionally, Rehman et al. (2022) performed a clinical trial to evaluate the Active Release Technique as a treatment for patients with piriformis syndrome. The researchers found that while both treatment techniques were effective in reducing the pain of the patients with piriformis syndrome and improving their range of motion, the Active Release Technique was more effective at reducing the functional disability of those patients, as measured by their LEFS score [20]. Thus, ART experienced significantly greater gains in both the reduction of pain and functional gains in comparison to the PFST technique after the treatment period. These outcomes indicate that while both techniques are beneficial for treating piriformis syndrome, the Active Release Technique leads to additional benefits for individuals with piriformis syndrome. The active release technique may be more beneficial due to the fact that it targets the adhesions that often form within soft tissues of the patients, while the PFST only targets the length and tone of the muscles [5,6]. Thus, the outcomes indicate that ART is an effective manual-therapy treatment for patients with piriformis syndrome, and that it may be more beneficial than other treatment techniques like PNST for piriformis syndrome [5,6,7,20].

CONCLUSION

The outcomes of the study indicate that both the Post-Facilitation Stretching Technique and the Active Release Technique are effective in the treatment of patients with piriformis syndrome. However, the outcomes also indicate that the Active Release Technique leads to significantly greater reductions in the pain that those patients experience, as well as experience significantly greater gains in their ability to function with their lower extremities. Thus, these outcomes suggest that while both manual therapies are beneficial for patients with piriformis syndrome, the Active Release Technique may be the more effective treatment to apply in the management of those patients.

LIMITATIONS

The limitations to this study included the small sample size of the participants ($n=30$), the narrow demographic of those individuals (ages 20-30 years old), the short time period during which the treatments were provided (eight weeks), and the fact that only two outcome measures were used to evaluate the effectiveness of each treatment.

FUTURE SCOPE

Future studies employing these treatment techniques could expand upon the current research by increasing the sample size, incorporating patients of different ages from different centers, providing follow-up treatment periods, incorporating additional outcome measures, and evaluating additional techniques.

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