Stretching Exercise Versus Tissue Mobilization Technique in Piriformis Syndrome

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ABSTRACT

Objective: The study was aimed to compare the effectiveness of stretching exercise and tissue mobilization techniques with piriformis syndrome patients.

Methods: Thirty-two participants were included in this study and they were classified into two groups. Group A, stretching exercise, hot pack, and group B, tissue mobilization technique, hot pack. Every group obtained two sessions in a week, for four weeks. The participants were assessed by (VAS), (RMQ), and (HAM-A).

Results: The comparison revealed that for RMQ there was a significant difference between groups in terms of the stretching exercise group ($P > 0.05$). For HAM-A and VAS, there were no statically significant differences between groups ($P < 0.05$), but the impact of both exercises indicates that stretching exercises have a higher positive effect comparing to tissue mobilization on pain.

Conclusion: The study proved which the stretching exercise was more efficient than the tissue mobilization technique on the pain outcome measures. It's reported that stretching exercise improves low back function more than tissue mobilization technique. In the end, the study indicated that significantly there was no difference between both groups on the anxiety outcome measure.

Keywords: Stretching exercise, Tissue mobilization technique, Piriformis syndrome, Positional release therapy.

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I. INTRODUCTION

Piriformis syndrome is a painful musculoskeletal condition, close to sciatica. It occurs as a result of sciatic nerve compression by piriformis muscle at the greater sciatic notch [1]. Yeoman was the first one who described PS in 1928 at the time he was studying low back pain causes [2]. In 1947, Robinson introduced piriformis syndrome as a term and he applied it to sciatica as it occurs as a result of abnormal muscle that usually traumatic in origin [3].

Prevention of LBP can often be by changing the patient's sitting position with a proper position and avoid sitting for long periods. Therapeutic methods are an effective way to treat many types of LBP such as bed rest, traction treatment, assistive devices, hyperthermia, manual therapy, electrical stimulation, and these methods would be the first choice for treatment of low back pain [4].

Clinical symptoms of PS may incorporate pain, numbness, tingling in the buttock region and it may go down the leg by the extension of the sciatic nerve. Symptoms may exacerbate by sitting with crossed leg or with gait[5]. Some of the factors that predispose piriformis syndrome may include cerebral palsy, trauma, excessive exercise, narrowed sciatic foramen, and altered biomechanics that may cause

stretching and shortening of piriformis syndrome [6].

There are many ways to diagnose piriformis syndrome in clinical practice such as computed tomography, bone scan, electromyography, magnetic resonance imaging, and nerve conduction velocity [7]. Decompression of sciatic nerve and release of the piriformis muscle is a method of surgical intervention [8]. Non-surgical management may include physical therapy, ultrasound, and correction of biomechanical abnormality [9].

Stretching is an exercise in which a specific muscle is flexed or stretched to improve the muscle elasticity and to achieve a comfortable muscle tone. Stretching exercise aims to improve the joint range of motion (flexibility), decrease muscle tension, improve circulation, and relative muscle pain [10]-[12].

Soft Tissue Mobilization is intended to be used as a therapy program that incorporates assessment and treatment of articular, neurovascular, and neuromuscular dysfunctions. The approach of the soft tissue mobilization incorporates assessment of the soft tissue system and utilization of explicitly guided manual therapy strategies to encourage standardization of soft tissue dysfunctions [13], [14]. This treatment approach has been termed functional mobilization [13], [14].

In the literary studies, there are few studies was focused on the effectiveness of stretching exercises and tissue mobilization techniques with piriformis syndrome patients and few studies have not indicated the effects of this technique on pain, function, and anxiety. Therefore, the study was done.

II. METHODS AND MATERIALS

A. Study Design

This study was organized in the physical therapy department at Palestine Ahliya University. An experimental study of piriformis syndrome. Thirty-two patients would be randomly distributed into two groups, group A 16 patients were included, they were given stretching exercise with a hot pack, and in group B 16 patients were included, they were given mobilization technique with a hot pack. Piriformis syndrome patients were selected depending on inclusion and exclusion criteria. A written assessment form was taken and the whole study was explained to the participated piriformis syndrome patients. The targeted patients were evaluated by the Visual Analogue Scale (VAS), Rolland Morris Questionnaire (RMQ), and Hamilton Anxiety Rating Scale (HAM-A). Inclusion criteria were as follows:

- 1) Age group 20- 55 years,
- 2) Gender group; both male and female participants,
- 3) Gluteal pain with or without radiation through sciatic nerve pathway,
- 4) FABER TEST and FAIR test to be positive,
- 5) Diagnosed sub-acute and chronic piriformis syndrome,
- 6) one-sided piriformis syndrome,
- 7) pain at least 3 according to visual analogue scale.

Exclusion criteria were as follows:

- 1) Intermittent vascular claudication, spondylolisthesis,
- 2) Past history of vertebral fracture,
- 3) Past history of spinal surgery,
- 4) Spinal tuberculosis,
- 5) Rheumatoid disease,
- 6) Disc pathology and mechanical back pain.

Group A: Follow these protocols:

- Stretching exercises
- Hot pack

Group B: Follow these protocols:

- Cross fiber friction
- Positional release therapy
- Hot pack.

B. Statistical analysis

Descriptive and frequency statistics were used to study the main characteristic of the sample. Means, standard deviation, and percentages. Continuous variables were given as mean $\pm$ standard deviation while categorical variables were given as number and percentage. Independent samples t-test was used to study the similarity of demographic data between groups. Wilcoxon Signed Ranks Test was used to study the change between pre-and post-treatment. G*Power software version 3.1.9.4. was used to calculate the effect size of the Wilcoxon Signed Ranks Test. The Mann-

Whitney test was used to study the comparison between the two protocols. The SPSS 24.0 software was used to study the difference in groups and within groups.

III. RESULTS

Thirty-two participated in patients with piriformis syndrome were included in the study. Following the data collection, the patients were divided into two groups. Group A stretching exercises and hot pack. Group B mobilization technique and hot pack. During four weeks of the treatment protocol, 16 patients were selected in group A and 16 patients in group B.

The average injury in both groups was 3.6 months, Of all group A patients, the average weight, 80Kg; average height, 158 cm; average age, 38 years; body mass index (BMI), 25.5, while group B; average weight, 82Kg; average height, 168 cm; average age, 38 years; body mass index (BMI), 29.2. Table I shows the demographic data of the included samples.

TABLE I: COMPARISON OF DEMOGRAPHIC DATA BETWEEN GROUPS

Variables	Group A Mean (SD)	Group B Mean (SD)	t- value	p-value
Age	38.4(9.5)	38.1(12.1)	0.081	0.936
Weight (Kg)	80.2 (17.7)	81.5 (12.5)	-2.511	0.081
Height (cm)	157.9 (14.5)	167.8 (10.0)	-0.384	0.704
BMI	25.5 (3.66)	29.2 (5.52)	-2.230	0.035

BMI: Body Mass Index; W: Weight; H: Height.

Table II shows the Comparison between pre- and post-VAS score within and between groups. The effect size found $d= 4.47$ in group A and $d= 2.43$ in group B which considered an extremely high effect size. Therefore, the power of the test is higher than 80%. This means that sample of 16 participants is enough to detect the effect of the treatment.

Wilcoxon signed ranks test in the group (A) shows the P-value is 0.000 which is less than $P = 0.05$. which means there is a statistically significant difference within this group in the pain before and after treatment with stretching exercise. Moreover, the results revealed the average pain before the treatment was 7.25 (1.7), while after the treatment the pain decreased to 1.19 (0.7). This means that stretching exercise treatment reduces piriformis muscle pain significantly.

Furthermore, Fig. 1 shows the result of the Wilcoxon signed ranks test in the group (B) reveals that the P-value is 0.000 which is less than $P = 0.05$. Therefore, it demonstrates there is a statistically significant difference within the group in the pain before and after the treatment with tissue mobilization technique. The averages score of the pain shows the mean pain score before the treatment was 6.69 (1.8), while after the treatment it decreased to 1.81(1.5). which means tissue mobilization technique reduces piriformis muscle pain significantly.

Fig. 1. Average VAS pain before and after the treatment.

Mann-Whitney test was used to examine the pre- and post-results between both groups. In the pre-values, the results of the test disclosed that the P-value before the two treatments was 0.361, which is greater than 0.05, which was no statistically significant difference between group A and group B of the pain before the treatment. This means that the two groups are considered identical. In addition, the P-value in post-tests was equal to 0.590, which is greater than 0.05, which is indicated no statistically significant difference between groups. This also means that both treatments have the same effect, they reduce the pain in the same manner. Nevertheless, the effect size calculations suggest that the stretching exercises have a higher effect than tissue mobilization on the affected piriformis muscle (see Table II).

TABLE II: COMPARISON BETWEEN PRE- AND POST VAS SCORE WITHIN AND BETWEEN GROUPS

Groups	Pre-treatment Mean $\pm$ SD	Post-treatment Mean $\pm$ SD	Effect Size	P value within Groups
A (stretching exercise)	7.25 $\pm$ 1.7	1.19 $\pm$ 0.7	4.47	0.000
B (tissue mobilization)	6.69 $\pm$ 1.8	1.81 $\pm$ 1.5	2.43	0.000
P value between Groups	0.361	0.590		

“24 items Roland-Morris Low Back Pain and Disability Questionnaire (RMQ)” was used to test the effect of the two treatment techniques on the piriformis muscle function. The patient is asked to tick a statement when it applies to him that specific day, this makes it possible to follow changes in time. The final score is the sum of the ticked boxes. The score ranges from 0 (no disability) to 24 (maximum disability).

For group A, the effect size calculations show that $d=2.29$ and $d=1.38$ in group B which are considered large effect size. Thus, it concludes that the power of the test is way higher than 80%. This means that a sample of 16 in both groups is quite enough to detect the effect of the treatment (stretching exercise) on the LBP.

On the other side, the results of the Wilcoxon Signed Ranks Test on group A showed the P-value is equal to 0.000. This means that there is a statistically significant difference between pre and post RMQ scores. In group A, the average RMQ score before the stretching exercise was

15.5. While after the treatment, the RMQ score decreased to 1.5. Consequently, it can conclude that stretching exercise can improve piriformis muscle function significantly.

Moreover, the P-value of the Wilcoxon signed ranks test for group B (tissue mobilization) was 0.001, which is less than 0.05. Hence, it deduces there is a statically significant difference between pre-and post-scores of the Roland-Morris LBP and disability Questionnaire (RMQ). Fig.2 demonstrates the Average RMQ scores before and after treatment. Examining the average score of RMQ before and after the tissue mobilization treatment revealed the RMQ score in group B before the treatment was 10.6. In the post measures, the average decreased to 3.5. This also means that tissue mobilization can reduce RMQ scores significantly (see Table III).

TABLE III: COMPARISON OF PRE-AND POST- RMQ SCORE WITHIN AND BETWEEN GROUPS

Groups	Pre-treatment Mean $\pm$ SD	Post-treatment Mean $\pm$ SD	Effect Size	P value within Groups
A (stretching exercise)	15.5 $\pm$ 6.9	1.5 $\pm$ 2.5	2.29	0.000
B (tissue mobilization)	10.6 $\pm$ 5.88	3.5 $\pm$ 3.3	1.38	0.001
P value between Groups	0.08	0.047		

RMQ: Roland-Morris Low Back Pain and Disability Questionnaire, SD: Standard deviation.

Fig. 1. Average RMQ scores before and after treatment.

Mann-Whitney test was used to compare pre and post RMQ scores between groups. Pre-treatment scores revealed the P-value was 0.08, which means there is no statically significant difference between both groups in RMQ scores before the treatment. However, the test on the post-treatment scores shows that the P-value was 0.047, which means is a statistically significant difference between group A and group B in RMQ scores after the treatment (see Table III).

“Hamilton Anxiety Rating Scale (HAM-A)” was used to study the results of both therapies on anxiety. The HAM-A is a clinician-rated scale that it has used to provide an analysis of the severity of anxiety in adults, adolescents, and children. Each item scored independently based on a five-point, ratio scale. A rating of 0 indicates the patient has no anxiety feels. A rating of 1 indicates mild prevalence; rating 2 indicates a moderate prevalence; rating 3 indicates severe prevalence; rating of 4 indicates a very severe prevalence. A composite score took place based on the summation of each

of the 14 individually rated items. These calculations yield a comprehensive score between 0 to 56. The test results revealed that a score of 17 or less indicates mild anxiety severity, A score from 18 to 24 indicates mild to moderate anxiety severity. Lastly, a score of 25 to 30 indicates a moderate to severe anxiety severity.

The effect size calculations present $d = 1.62$ in group A and $d = 1.22$ in group B which are considered large effect sizes. Thus, it concludes that the power of the test is higher than 80. Furthermore, the outcomes of the Wilcoxon signed ranks test revealed the P-value equals 0.001. This means there is a statistically significant difference between pre-and post-treatment values.

Figure 3 shows the average HAM-A before and after treatment. The outcomes of the Wilcoxon signed ranks test also revealed the P-value equal to 0.001. The pre- average anxiety in group B was 14.12. This average decreased to 10.31 after the tissue mobilization treatment. Therefore, the tissue mobilization treatment decrease anxiety significantly (see Table IV).

TABLE IV: COMPARISON OF PRE- AND POST- ANXIETY TEST WITHIN AND BETWEEN GROUPS

Groups	Pre-treatment Mean $\pm$ SD	Post-treatment Mean $\pm$ SD	Effect Size	P value within Groups
A (stretching exercise)	11.56 $\pm$ 7.31	6.31 $\pm$ 5.90	1.62	0.001
B (tissue mobilization)	14.12 $\pm$ 8.49	10.31 $\pm$ 17.09	1.22	0.001
P value between Groups	0.468	0.224		

HAM-A: Hamilton Anxiety Rating Scale, SD: Standard deviation.

Fig. 1. Average Hamilton Anxiety Scale scores before and after treatment.

Mann-Whitney Test was used to compare pre- and post-anxiety scores between the participated groups. The pre-treatment scores revealed a P-value of 0.468, which is greater than 0.05. Therefore, it means there is no statically significant difference between both groups in anxiety scores before the treatment. While the post-treatment scores present a P-value of 0.224. Which is more than 0.05, so that indicates that there is no statistically significant difference between group A and group B in anxiety scores after the treatment (see Table IV).

IV. DISCUSSION

The study was conducted to compare the effectiveness of stretching exercise and tissue mobilization technique on pain, function, and anxiety in patients with PS. Symptoms of piriformis syndrome cause pain, numbness, tingling in the buttock region and it may go down to the leg through the extension of the sciatic nerve. Symptoms may exacerbate by sitting with crossed leg or with gait [5].

32 PS patients were undertaken in the current study and they have been divided into two groups. The males and females in participants were 31% males and 69% were females. In our results reported that stretching exercises are effective more than tissue mobilization techniques on pain. Also, stretching exercises can improve piriformis muscle function when applicants on PS, and finally there was no significant difference between both treatments on anxiety.

Mulla and Gosavi, in their study “Effect of stretching exercise and neural tissue mobilization in piriformis syndrome”. They conducted a study on 42 subjects, the participants have suffered PS. 12 patients did not come for follow up and out of 30 patients. The mean age of participants included in group A (experimental group) was 26.13 and group B (conventional group) was 25.06 [15]. The findings of the study were shown that the combination of neural tissue mobilization along with conventional physiotherapy treatment has an extremely significant effect over conventional physiotherapy treatment alone in the management of piriformis syndrome.

Mulla and Gosavi have reported the relationship between stretching exercise and RMQ, the pre-interventional was 14.46 and the post-interventional was 4.4 for the group that used stretching exercise. However, there are no statistically significant differences in RMQ comparing between group A and group B in the pre-interventional. On the other hand, RMQ on comparing the post-interventional values for group A and group B has a statistically extremely significant difference. Also, they have reported the relationship between stretching exercise and pain (VAS). The pre-interventional mean was 9.13 and the post-interventional mean was 2.33. Post-interventional value for VAS for group A and group B (which had stretching exercise) has statistically extremely significant difference [15].

Compared to our study as the results of stretching exercises on pain at VAS between pre-interventional and post-interventional for both groups, there was no statistically significant difference between the two treatments. After comparison, group A and group B have no significant difference on pain threshold but the effect size calculations suggest that stretching exercises have a higher effect on pain in cases of piriformis syndrome. The mean values for VAS in both studies were close together in the results. Additionally, stretching exercises can improve piriformis muscle work when applied to piriformis syndrome [16]-[18].

Fernández-de-las-Peñas et al. reported in their study “the immediate effect of ischemic compression technique and transverse friction massage on tenderness of active and latent myofascial trigger points, a pilot study that there was a significant decrease in the VAS within each group, which

means that the transverse friction massage is effective in decreasing pain of trigger points [19].

In another study was done by Hassan et al. "The effect of deep friction massage versus stretching of wrist extensor muscles in the treatment of patients with tennis elbow" they have reported that there was a significant improvement of pain for patients who had deep friction massage [20], [21]. These results agree with our results of the tissue mobilization technique, which is included, a cross-fiber friction effect on pain where the decrease in the pain in patients was significant.

Mohamed and El Shiwi in their study, the effect of therapeutic exercises with or without positional release technique in the treatment of chronic mechanical LBP patients. They reported there were no significant differences between groups in functional disability at the pre-treatment stage, and there was a significant difference in favor of the group that had PRT on functional disability at post-treatment stage [22]. On the other hand, the present study was found that there is no statically significant difference between the two groups in RMQ scores pre- and post-the treatment. Tissue mobilization can reduce RMQ scores significantly. Therefore, the tissue mobilization technique on the piriformis syndrome can improve the function of the low back.

A variety of physical diseases can give rise to depression and anxiety. In some cases, depressive and anxious symptoms are characteristic of an underlying medical disease and present as the first manifestations of the somatic disease. In other cases, depression or anxiety may be related to a previously diagnosed disease, as in certain neurological and endocrine disorders [23].

McWilliams et al. in their study "Depression and anxiety associated with three pain conditions: results from a nationally representative sample" reported that the associations between the pain conditions and the anxiety disorders were generally larger than those between the pain conditions and depression. These findings add to a growing body of evidence indicating that anxiety disorders warrant further attention in relation to pain.

In another study was done by Castro-Sánchez et al. "Benefits of massage-myofascial release therapy on pain, anxiety, quality of sleep, depression, and quality of life in patients with fibromyalgia" they reported in their results that the experimental group who had myofascial release massage showed a significant improvement in treat anxiety versus pre-intervention and in comparison, to the placebo group after 20-week post intervention [24].

The current study has shown that there is a statistically significant difference between pre-and post- values in anxiety. This means that there is a statistically significant difference between pre-and post- values. Therefore, stretching exercises and tissue mobilization treatments decreases anxiety.

The current findings reported that anxiety may be associated with pain conditions such as musculoskeletal conditions, and physical therapy intervention for those pain conditions may reduce the anxiety symptoms. The current study was in agreement with the previous studies for

reducing anxiety symptoms.

The stretching exercise showed a better effect in reducing pain and function in patients with PS and also both treatments showed an effect on anxiety with those patients, so these treatments could be used in the future by the physiotherapists and they could focus on stretching rather than tissue mobilization according to the results. Our weakness points in the present study consisted there had not found enough studies about the relationship between anxiety and musculoskeletal pain.

V. CONCLUSION

This study revealed that stretching exercise is effective more than tissue mobilization techniques on pain. It also clear that stretching exercises improves low back function more than tissue mobilization techniques. And finally, it found that there was no significant difference between both groups on anxiety.

ETHICAL CLEARANCE

An ethical permit was obtained from the Ethical committee of Pamukkale University, to allow patients information to be taken in order to apply the study while keeping the patient's names anonymous.

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