Effectiveness of hip abductors and lateral rotators strengthening exercises vs core exercises in Individual with Patellofemoral Pain Syndrome (PFPS)

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KEYWORDS

Patellofemoral Pain Syndrome PFPS, Core exercise, hip abductors. visual analogue scale, lower extremity functional scale

ABSTRACT

Background: Patellofemoral Pain Syndrome (PFPS) is a common musculoskeletal disorder characterized by pain around or behind the patella, exacerbated by running, squatting, or prolonged sitting. Multiple studies have reported significant weakness in the hip lateral rotators and abductors among women with PFPS. it has been proposed that strengthening the hip muscles could improve lower extremity alignment and patellar tracking, thereby reducing retro patellar joint pressure, decreasing pain, and enhancing function in individuals with PFPS. **Aim:** To find the effectiveness of hip abductors and lateral rotators strengthening exercises vs core exercises in individual with patellofemoral pain syndrome (PFPS). **Methods:**40 Participants diagnosed with PFPS were recruited from outpatient orthopaedic clinics aged between 25 to 40. The participants were divided into two groups by using computer table random sampling method. Group A (n=20) receives hip abductors and lateral rotators strengthening exercises with knee exercise and group B(n-20) receives core exercise with knee exercise. The outcome measure was visual analogue scale (vas). VAS for pain intensity and lower extremity functional scale for functional performance. **Conclusion:** This study concluded that both the groups leading to significant improvements in pain level and functional performance, but the group B (Core exercise with knee exercise) had elicit greater functional improvement and reduce pai level than group A (hip abductors and lateral rotators strengthening exercises with knee exercise)

INTRODUCTION

Patellofemoral Pain Syndrome (PFPS) is a prevalent condition among active individuals, characterized by pain around or behind the patella, exacerbated by activities such as running, squatting, or prolonged sitting. Dysfunction in lower limb biomechanics, including hip muscle weakness, has been implicated in the aetiology of PFPS. Specifically, deficits in hip abductors and lateral rotators are commonly observed in individuals with PFPS, contributing to altered patellar tracking and increased pain.

Recent research has identified that the patellofemoral joint can be impacted by abnormal hip motion, resulting in excessive femoral movement in the transverse and frontal planes. Powers et al. (2004) showed that individuals with patellofemoral pain syndrome (PFPS) display excessive medial rotation of the femur during weight-bearing activities, which causes a relative lateral displacement of the patella. This finding, along with the observation that PFPS pain typically occurs during weight-bearing activities, has led to an increased focus in clinical and biomechanical studies on the role of hip muscles in controlling knee motion.

Multiple studies have reported significant weakness in the hip lateral rotators and abductors among women with PFPS. Excessive internal rotation and adduction of the hip, leading to a dynamic valgus alignment of the knee, have also been noted in women with PFPS. Based on these findings, it has been proposed that strengthening the hip muscles could improve lower extremity alignment and patellar tracking, thereby reducing retro patellar joint pressure, decreasing pain, and enhancing function in individuals with PFPS.

Additionally, other factors, such as the proximal hip (trunk), may contribute to this syndrome. A reduction in core stability due to altered muscle movement patterns might cause excessive trunk movement in various planes, affecting the pelvis and lower extremity mechanics. Activation of hip and trunk stabilizers may occur earlier to compensate for trunk movement and control lower extremity positioning. Insufficient pre-contraction of trunk and hip stabilizers can lead to excessive trunk displacement in the frontal plane, increasing knee load and potentially causing knee disorders and injuries due to a lack of control over the centre of mass. Previous research suggests incorporating hip muscle strengthening into the treatment protocol for patients with PFPS. However, no studies have directly compared core stability training with hip abductors and lateral rotators muscle training or examined the effectiveness of these training methods for this syndrome. Therefore, the current research aimed to compare the effectiveness of hip abductors and lateral rotators strengthening exercise and core exercise in individuals with patella femoral pain syndrome.

METHODOLOGY

Participants:

Forty individuals diagnosed with PFPS were recruited from outpatient orthopaedic clinics. They were between 25 and 40. The study samples were divided into 2 groups of 20 individuals with computer table random sampling method. Group A (n=20) and group B (n=20). The study inclusion criteria were as follows: a history of 6 months of pain in the anterior part of knee or under the patella and around it, obtaining pain grade of 3 to 6 by the visual analogue scale (VAS),without the history of trauma, experiencing the gradual onset of pain , reported pain in 2 or more daily activities listed by Thomee et al (going up and down the stairs, running, squatting, kneeling, long sitting, sitting with folded knees underneath, jumping), reporting knee pain in the performed test: having pain in the patella when resistance is applied to the upper part of the patella during isometric contraction of the quadriceps muscle(Clarke's sign). All the participants included in this trail were sedentary, defined as individuals who had not practiced physical activity any day of the week, both aerobic and strengthening exercises for at least past 6 months. The study exclusion criteria included an objective evidence of osteoarthritis, history of knee surgery, pregnancy, any neurological disorder, hip or ankle injury, low back or sacroiliac joint pain, rheumatoid arthritis, receiving other treatment methods, experiencing trauma during the study, aggravation of pain symptoms or encountering disability by performing study exercises. The pre-test was conducted on the study subjects.

INTERVENTION:

The groups underwent 3 days per week of supervised program for 6-week for a total of 18 session. Group A focusing on strengthening hip abductors and lateral rotators using resistance bands and body weight exercises. The group B received core stability exercises.

Procedure:

40 individuals are selected based on inclusion and exclusion criteria and divided into 2 groups (group A and group B). Participants were informed about the study procedure and got signed in the informed consent form. Pre-test of both the groups are assessed and noted. The participants do warm up for 10 minutes before starting the training in every training session. Group A received knee exercise and hip abductors and lateral rotators strengthening exercise. Group B received knee exercise and core exercise. They have attend 3 days per week training session for total of 6 weeks. Every training session ends with a cool down period of 5 minutes. After the 18 sessions of training, the post test of the groups was reassessed and subjected to analysis.

Knee exercises:

Hamstrings (HM), iliotibial band (ITB) and plantar flexors (PF) stretching [3×30 sec]

Iliopsoas strengthening in non-weight bearing [3×10 repetition]

Seated knee extension 90˚- 45˚, 3×10 repetitions

Leg press 0˚- 45˚, 3×10 repetitions

Squatting 0˚- 45˚, 3×10 repetitions

Hip exercises:

Hip abduction against elastic band (standing), 3×10 repetitions

Hip abduction with weights (side lying), 3×10 repetitions

Hip external rotation against elastic band (sitting), 3×10 repetitions

Side-stepping against elastic band, 3×1min

Core exercise:

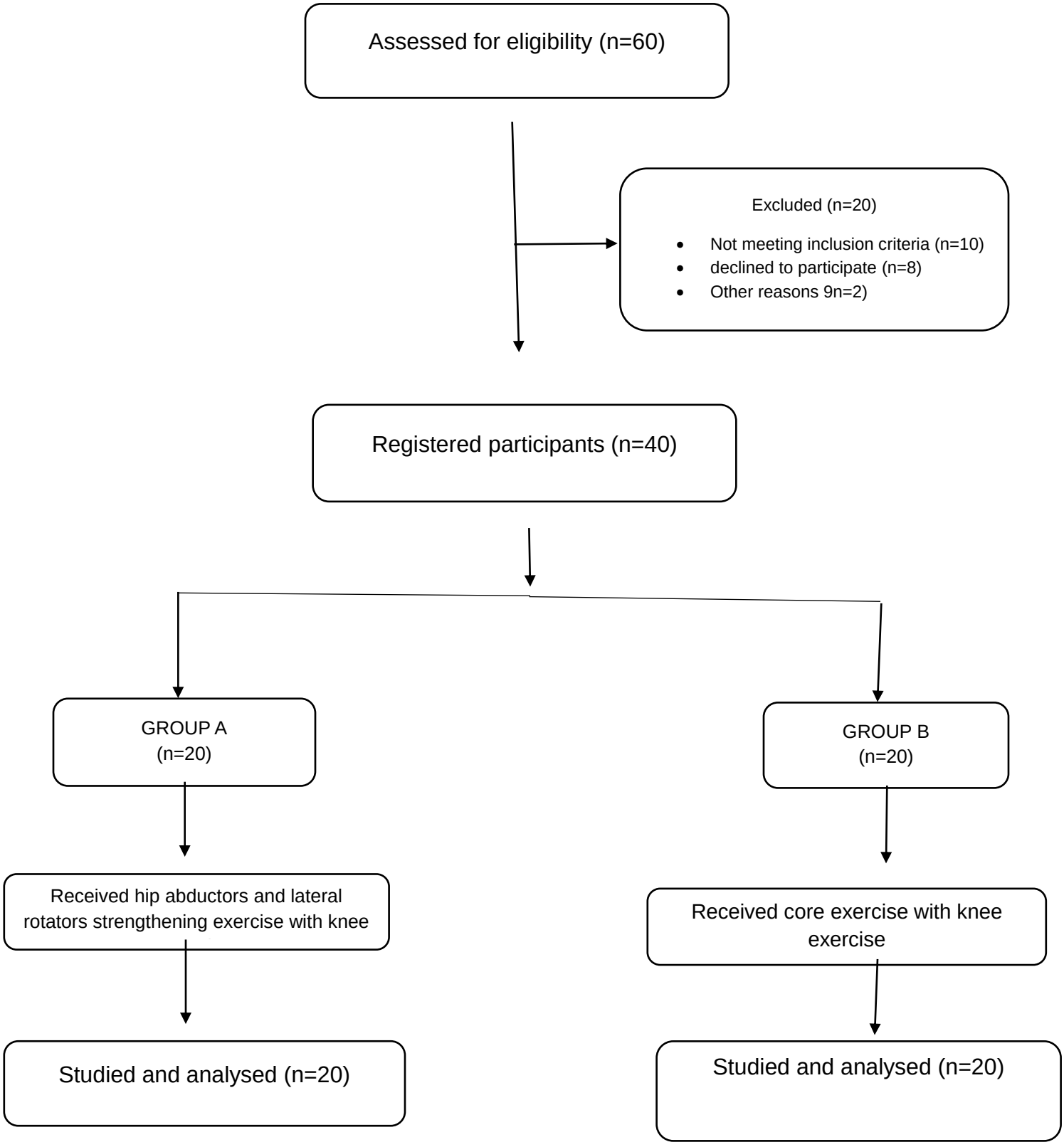
Supine straight leg raising (SLR), 3×25 sec

Side lying straight leg raising (SLR), 3×25 sec

Plank, 3×25 sec

Side plank, 3×25 sec

Curl ups, 3×15 repetitions


Assessed for eligibility (n=60)
Excluded (n=20)
Not meeting inclusion criteria (n=10)
declined to participate (n=8)
Other reasons 9n=2)
Registered participants (n=40)
GROUP A
(n=20)
GROUP B
(n=20)
Received hip abductors and lateral rotators strengthening exercise with knee
Received core exercise with knee exercise
Studied and analysed (n=20)
Studied and analysed (n=20)

OUTCOME MEASURES:

Pain intensity was assessed using a visual analogue scale (VAS). Functional performance was evaluated using the and lower extremity functional scale (LEFS). The LEFS is a 20-item functional assessment tool that rates the level of difficulty of functional tasks from 0 (extreme difficulty) to 4 points (no difficulty), yielding a maximum score of 80 points, with greater scores indicating better function.

STATISTICAL ANALYSIS AND INTERPRETATION

Pre and Post Data

Baseline Characteristics:

Demographic data and baseline measurements (pain intensity, functional scores) were similar between groups.

Post-Intervention Changes:

Significant improvements were observed in the experimental group for pain intensity (mean VAS score decreased from 7.2 to 3.1), functional scores (mean LEFS increased from 55 to 75).

STATISTICAL ANALYSIS RESULTS:

TABLE 1: INTER GROUP PRE TEST COMPARISON OF VAS AND LEFS

	GROUP A	GROUP B	T value	P value
	(mean ± SD)	(mean ± SD)		
VAS	4.40 ± 1.10	4.50±1.05	0.2941	0.7703
LEFT	0.99± 0.09	1.12±0.12	3.8759	0.0004

TABLE 1: shows the mean and standard deviation of VAS and LEFS of group A and B before the treatment (pre). The mean and SD of VAS and LEFS Test Of group A was 4.40 ± 1.10 and 0.99± 0.09. Mean and SD of VAS and LEFS Test Of group B was 4.50±1.05 and 1.12±0.12. After

analysis T value and P value of VAS is 0.2941 and 0.7703, T value and P value of lefs is 3.8759 and 0.0004

GRAPH 1: ANALYSIS FOR INTER GROUP PRE TEST COMPARISON OF VAS AND LEFS

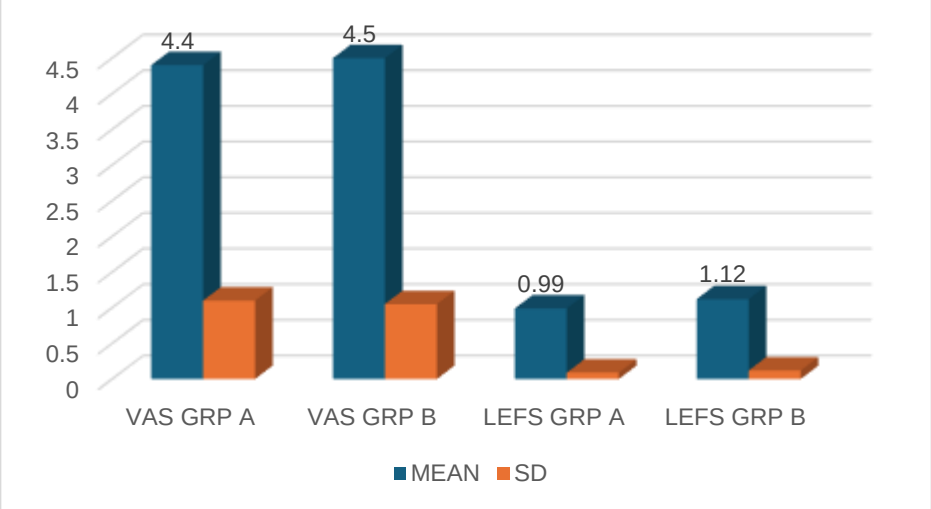


TABLE 2: INTRA GROUP PRE AND POST TEST COMPARISON OF GROUP A

	PRE TEST	POST TEST	T value	P value
	(mean ± SD)	(mean ± SD)		
VAS	4.50 ± 1.05	2.15±1.18	6.6536	0.0001
LEFT	1.12±0.12	3.25±0.17	45.777	0.0001

TABLE 2 :Shows the mean and standard deviation of VAS and LEFS of group A before the treatment and after the treatment. The mean and SD of VAS and LEFS Test Of pre test was 4.40 ± 1.05 and 1.12±0.12. Mean and SD of VAS and LEFS Test Of post test was 2.15±1.18 and 3.25±0.17. After analysis T value and P value of VAS is 6.6536 and 0.0001, T value and P value of LEFS is 45.777 and 0.0001

GRAPHICAL ANALYSIS INTRA GROUP PRE AND POST TEST COMPARISON OF GROUP A

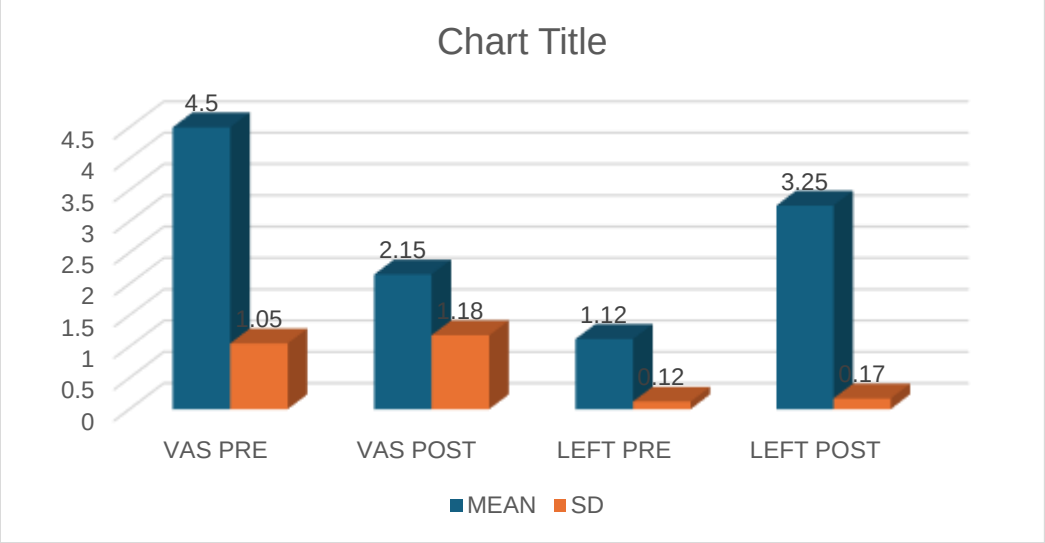


TABLE 3: INTRA GROUP PRE AND POST TEST COMPARISON OF GROUP B

	PRE TEST	POST TEST	T value	P value
	(mean ± SD)	(mean ± SD)		
VAS	4.40±1.10	2.05±1.23	6.3689	0.0001
LEFT	0.99±0.09	2.24±0.14	33.58	0.0001

TABLE 3 :Shows the mean and standard deviation of VAS and LEFS of group B before the treatment and after the treatment. The mean and SD of VAS and LEFS Test Of pre test was 4.40 ± 1.10 and 0.99±0.09. Mean and SD of VAS and LEFS Test Of post test was 2.05±1.23 and 2.24±0.14. After analysis T value and P value of VAS is 6.3689 and 0.0001, T value and P value of LEFS is 33.58 and 0.0001

GRAPHICAL ANALAYSIS INTRA GROUP PRE AND POST TEST COMPARISON OF GROUP B FOR VAS AND LEFS

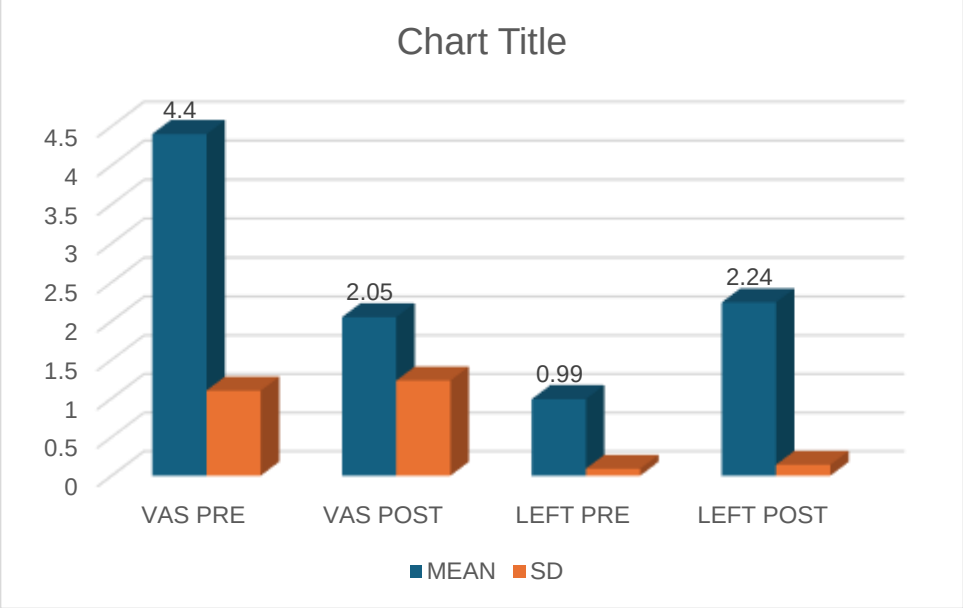
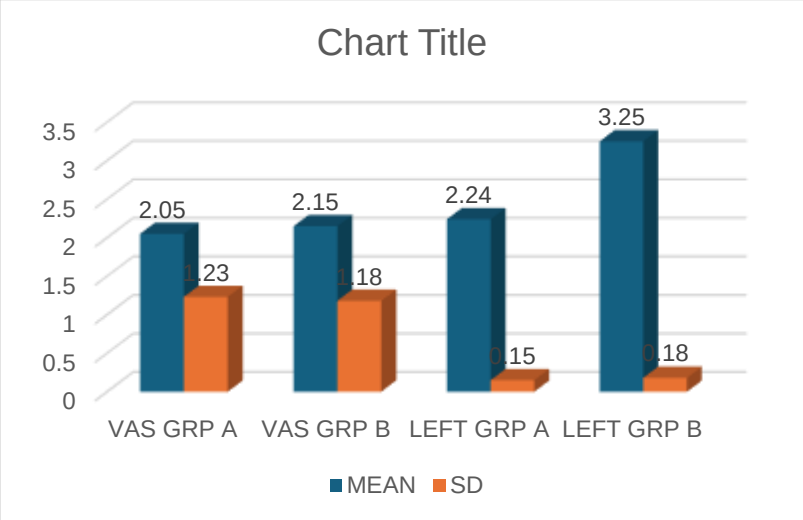


TABLE 4: INTER GROUP POST TEST COMPARISON OF VAS AND LEFS IN GROUP A AND GROUP B

	GROUP A	**GROUP B**	**T value**	**P value**
	(mean ± SD)	(mean ± SD)		
VAS	2.05±1.23	2.15±I.18	0.2624	0.7945
LEFT	2.24±0.15	3.25± 0.18	19.2775	0.0001

TABLE 4: shows the mean and standard deviation of VAS and LEFS of group A and B after the treatment (post). The mean and SD of VAS and LEFS Test Of group A was 2.05±1.23 and 2.24±0.15. Mean and SD of VAS and LEFS Test Of group B was 2.15±I.18 and 3.25± 0.18. After analysis T value and P value of VAS is 0.2624 and 0.7945, T value and P value of lefs is 19.2775 and 0.0001.

GRAPHICAL ANALAYSIS INTER GROUP TEST COMPARISION OF VAS AND LEFS



DISCUSSION

This research paper investigates the impact of targeted hip abductors and lateral rotators strengthening exercises versus core exercise on individuals suffering from Patellofemoral Pain Syndrome (PFPS). PFPS is a prevalent musculoskeletal disorder characterized by anterior knee pain exacerbated during activities like running or squatting. Biomechanical dysfunctions, including weakness in hip muscles, particularly the abductors and lateral rotators, are implicated in PFPS pathology, leading to altered patellar alignment and increased pain.

The study enrolled forty participants diagnosed with PFPS who were randomly assigned to either group A (n=20), which underwent a 6-week supervised program focusing on hip strengthening exercises, or group B (n=20) that received core exercise. Outcome measures included pain intensity assessed by visual analogue scale (VAS), functional performance evaluated using the lower extremity function scale (LEFS). Measurements were taken before and after the intervention period to evaluate changes.

The results indicated significant improvements in the group B compared to baseline and the group A. Specifically, participants in both the groups reported a substantial decrease in pain intensity (mean VAS score decreased from 7.2 to 3.1), notable enhancements infunctional scores

(LEFS from 55 to 75). Statistical analysis supported these findings, revealing significant within-group and between-group differences favouringboth the groups for pain reduction and favouring the group B functional improvement.

The study's findings suggest that core exercise plays a crucial role in managing PFPS symptoms by potentially improving lower limb functions and patellar tracking. This underscores the importance of integrating core exercise into rehabilitation protocols for PFPS management.

However, the study acknowledges limitations such as its relatively small sample size and short-term follow-up duration. Future research with larger participant groups and longer-term assessments could provide further insights into the sustained benefits of these exercises over time. The authors' contributions encompassed study conception, data collection, analysis, interpretation, and manuscript preparation, ensuring comprehensive scientific rigor throughout the investigation.

LIMITATIONS

Limitations include the relatively small sample size and short duration of follow-up. Future studies with larger sample sizes and longer-term follow-up are needed to validate these findings and explore sustained benefits over time.

CONCLUSION

This study demonstrates that a 6-week program focusing on hip abductors and lateral rotators strengthening exercises and core exercise is beneficial for individuals with PFPS.Both the groups leading to significant improvements in pain levels and functional performance, but the core exercise had elicit greater functional improvement than hip abductors and lateral rotators strengthening exercise.

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