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Role of Clamshell Exercises on Pain and Functional Outcomes in Patients with Patellofemoral Pain Syndrome

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KEYWORDS

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DECLARATIONS

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ABSTRACT

Background: Patellofemoral Pain Syndrome is often linked to abnormal biomechanics of the patellofemoral joint, which can result from weakened hip abductors and external rotators. Targeted strengthening exercises, like the clamshell, can help restore proper alignment and movement patterns in early rehabilitation. **Objective:** To assess the role of clamshell exercises on pain and functional outcomes in patients with patellofemoral pain syndrome. **Methodology:** This cross-sectional study was conducted during a six-month duration after approval of the topic, from July to December 2022. Data was collected from Ghurki Trust Teaching Hospital, Lahore, Pakistan, Physiogic Physical Therapy Clinic, Lahore, Pakistan, and Revive Spine & Pain Relief PT Clinic, Lahore, Pakistan. Patients aged between 19 and 44 years diagnosed with Patellofemoral Pain Syndrome resulting from hip musculature weakness, must had a Kujala score of less than 33, were included in the study. Individuals with a previous history of patellar dislocation, fracture, bursitis, knee surgery, ligamentous laxity, meniscal injury, pes anserine bursitis, and iliotibial band syndrome were excluded. The Kujala Anterior Knee Pain Scale was used to assess functional outcome, and the Numeric Pain Rating Scale was used to assess pain in patients with patellofemoral pain syndrome. The study variables were expressed in the form of descriptive statistics (tables, graphs, frequencies, and percentages). The age and total score of the AKPS were expressed through a histogram, and the total score of the NPRS was expressed using a pie chart, while gender and marital status were expressed using a bar chart. **Results:** The mean score of functional outcomes of 73 patients receiving clamshell exercises measured using the Kujala Anterior Knee Pain Scale was 66.88±18. On the Numeric pain rating scale, 1(1.4%) patients had no pain, 28(38.4%) patients had mild and an equal number of patients had a moderate level of pain, while 16(21.9%) patients still experienced severe pain. **Conclusion:** Pain and functional outcomes significantly improved after receiving clamshell exercise for six weeks. The pain was reduced between mild to moderate, and the functional outcome was improved to a moderate level. The greater the score on the Kujala Anterior Knee Pain Scale better the functional outcomes.

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INTRODUCTION

Patellofemoral pain syndrome is characterised by pain located behind or around the patella. It is caused by physical or biomechanical changes in the patellofemoral joint.[1] The high levels of physical activity and excessive use of the patellofemoral joint are seen in patients with patellofemoral pain. The pain worsens with prolonged sitting, squatting, kneeling, and stair climbing.[2] When the patellofemoral joint is not loaded, pain is rarely present (during standing, sleeping, and resting). Even though the dominant symptom is pain, patients often also complain about knee stiffness, patellofemoral crepitus, difficulty in performing daily activities, and a poor quality of life.[3]

At least one episode of patellofemoral pain occurs in 1 out of every 4 patients.[1] Annual prevalence is 22.7% in the general population and 28.9% in adolescents (13-18 years).[4] Whereas in Pakistan prevalence in both genders aged between 18-35 is 19%. Although it is more common in females than in males.[5] Altered joint kinematics in patients with patellofemoral pain syndrome is caused by excessive internal rotation as opposed to lateral patellar rotation. Therefore, by controlling the rotation of the femur, normal patellofemoral joint kinematics can be restored.[6] Hip abductors are mainly focused on by clinicians when treating conditions like low back pain and lower extremity injuries, such as patellofemoral pain.[7] Gluteus medius plays an important role in hip abduction, gait, and stabilisation of the pelvis.[8] This muscle is weakened and its activity is delayed in patellofemoral pain syndrome.[9]

Clamshell is a common therapeutic exercise to strengthen the hip abductors. During this exercise, hip abductor recruitment occurs.[7] Open-chain hip external rotation and abduction are produced by clam activity that is used early in the rehabilitation when weakness of hip abduction and external rotation exists.[1] Gluteus medius activation is greatest when the hip is flexed at 60 degrees.[7] According to a study, the ideal hip flexion angle for the clamshell exercise is 60 degrees.[10] Physical therapists use a variety of pain scales. One of the commonly used scales is the Numeric Pain Rating Scale (NPRS). It ranges from 0 to 10, with the patient being asked to select a number that best describes his pain. 0 represents no pain, whereas 10 represents the worst possible pain. NPRS can be used reliably for patients with musculoskeletal disorders and no cognitive problems.[11] Kujala Anterior Knee Pain Scale (AKPS) is a 13-item questionnaire. Its total score ranges from 0 to 100, with 100 representing no disability. AKPS is a reliable, valid, and responsive tool for assessing treatment outcomes in patients with patellofemoral pain.[12]

The purpose of this study is to examine the role of clamshell exercises on pain reduction and functional improvements in patients with patellofemoral pain. By focusing on strengthening the hip musculature, the research aims to provide physical therapists with an effective therapeutic approach for managing this condition, ultimately enhancing patient outcomes and reducing discomfort.

METHODOLOGY

This cross-sectional study is used to examine the relationship between the disease and other variables or characteristics of the population. Non-probability convenient sampling technique was used, and the duration of the study was six months after approval of the topic, from July to December 2022. Data was collected from 3 institutes: Ghurki Trust Teaching Hospital, Lahore, Pakistan, Physiogic Physical Therapy Clinic, Lahore, Pakistan, and Revive Spine & Pain Relief PT Clinic, Lahore, Pakistan. The census method was used to calculate the sample size.

All the participants (n=73) fulfilling the inclusion criteria were included in the study. The inclusion criteria for this research study are adults aged between 19 and 44 years who have been diagnosed with Patellofemoral Pain Syndrome (PFPS) resulting from hip musculature weakness, and must have a Kujala score of less than 33. Individuals with a previous history of patellar dislocation, patellar fracture, or any knee surgery. Additionally, participants with ligament laxity, meniscal injury, pes anserine bursitis, iliotibial band syndrome, or patellar bursitis as the primary cause of their current symptoms were excluded. Patients exhibiting an imbalance between the vastus medialis and lateralis muscles are also excluded from the study. These factors ensure that the study focuses on participants with PFPS, specifically related to hip musculature weakness. The tools used in this study are NPRS and AKPS. The pain scale ranges from 0 to 10, with the

patient being asked to select a number that best describes his pain. 0 represents no pain, whereas 10 represents the worst possible pain. NPRS can be used reliably for patients with musculoskeletal disorders and no cognitive problems.[11] The AKPS is a 13-item questionnaire. Its total score ranges from 0 to 100, with 100 representing no disability. AKPS is a reliable, valid, and responsive tool for assessing treatment outcome in patients with patellofemoral pain.[12]

Data analysis was done using the Statistical Package for Social Sciences version 26. The study variables were expressed in the form of descriptive statistics (tables, graphs, frequencies, and percentages). The age and total score of the AKPS were expressed through a histogram, and the total score of the NPRS was expressed using a pie chart, while gender and marital status were expressed using a bar chart.

RESULTS

The mean score of functional outcomes of 73 patients receiving clamshell exercises measured using the Kujala Anterior Knee Pain Scale was 66.88±18. On the Numeric pain rating scale, 1(1.4%) patients had no pain, 28(38.4%) patients had mild and an equal number of patients had a moderate level of pain, while 16(21.9%) patients still experienced severe pain, as shown in Table 1.

DISCUSSION

Our cross-sectional study demonstrated that clam shell exercises performed on patients with patellofemoral pain syndrome reduced the pain and improved their functional outcome The findings of my study were in line with a previous study by Anis Jelled et al., which showed that combining stretching and strengthening of the hip internal and external rotators in addition to a standard rehabilitation programmed significantly improved pain and function in patients with PFPS compared to a standard rehabilitation programmed alone.[13] Our findings are consistent with those of Fukuda et al., who performed a randomised control experiment to examine the effects of strengthening the hip abductors and lateral rotators on pain and function in female PFPS patients. They found that sedentary women with PFPS responded well to rehabilitation programs that focused on knee-strengthening activities and knee-strengthening exercises augmented with hip-strengthening exercises. Furthermore, the group that engaged in hip-strengthening exercises saw bigger reductions in pain and gains in function.[14]

Many studies report the importance of hip strengthening exercises in managing pain and improving the quality of life in patients with PFPS. A study conducted by Dolak et al. compared the results of initial hip strengthening exercise before other functional exercises to quadriceps strengthening in females with patellofemoral pain syndrome. The study concluded that initially strengthening the hip musculature caused an earlier dissipation of pain and produced better functional outcomes than exercises that focused on the quadriceps.[15] The results of this study are also in line with our study, which concludes that clam-shell exercises that strengthen hip musculature (gluteus medius and gluteus maximus) reduce pain and improve the functional outcomes in PFPS.

Our study's findings concurred with those of the study conducted by Feber et al., who ran a randomised control trial comparing the results of hip and core rehabilitation to knee rehabilitation. Both the hip and knee rehabilitation protocols produced improvement in PFP, function, and strength over 6 weeks. Despite identical results, the hip program produced quicker pain relief and more total strength gains than the knee treatment.[16] However, the results of our study were in contrast with the findings of Avraham et al, who found no difference between hip external rotator and quadriceps strengthening compared with quadriceps strengthening alone. This could be explained by the relatively small sample size and the short follow-up period in their study.[17]

The major limitation of this study was that the participants probably created a bias in recording the pain and functional outcomes score, as these were subjective complaints. In addition, some of the confounding variables were not controlled, i.e., there was a probability that the home exercise plan (HEP) might not have been followed by some of the participants included in our study. Another limitation was that patellofemoral pain caused by ligamentous laxity, tight tensor fascia lata, plica syndrome, and Hoffa's fat pad syndrome were not included in our study. The result of this study suggested the usefulness of adding clam-shell exercises in the rehabilitation protocol of patients with PFPS, but the specific benefits remained unclear. Thus, further high-quality clinical trials

Table 1: Frequency and percentages of AKPS

Category	Subcategory	Frequency (n)	Percentage (%)
Limping Status	Constant	5	6.8
	Slight or Periodical	22	30.1
	None	46	63.0
Support Status	Weight Bearing Impossible	5	6.8
	Painful	25	34.2
	Full Support Without Pain	43	58.8
Walking Ability	Unable	4	5.5
	1-2 km	28	38.4
	More than 2 km	16	21.9
	Unlimited	25	34.2
Stair Climbing Ability	Unable	6	8.2
	Pain During Both Descending & Ascending	23	31.5
	Slight Pain When Descending	30	41.1
	No Difficulty	14	19.2
Squatting Ability	Unable	5	6.8
	Possible with Partial Weight Bearing	9	12.3
	Painful Each Time	21	28.8
	Painful with Repeated Squatting	35	47.9
	No Difficulty	3	4.1
Running Ability	Unable	5	6.8
	Severe Pain	14	19.2
	Slight Pain from Start	21	28.7
	Pain After More than 2 km	23	31.5
	No Difficulty	10	13.7
Jumping Ability	Unable	18	24.7
	Constant Pain	21	28.5
	Slight Difficulty	28	38.3
	No Difficulty	6	8.2
Prolonged Sitting (Knees Flexed)	Unable	6	8.2
	Pain Forces to Extend Knees Temporarily	17	23.3
	Constant Pain	14	19.2
	Pain After Exercise	23	31.5
	No Difficulty	13	17.8
Pain Status	Constant & Severe	2	2.7
	Occasionally Severe	17	23.3
	Interferes with Sleep	8	11.0
	Slight & Occasional	35	47.9
	None	11	15.1
Swelling Status	Constant	1	1.4
	Every Evening	12	16.4
	After Daily Activities	15	20.5
	After Severe Exertion	24	32.9
	None	21	28.8
Abnormal Painful Kneecap Movements	More than Two Dislocations	1	1.4
	At Least One Documented Dislocation	4	5.47
	Occasionally in Daily Activities	19	26.0
	Occasionally in Sports Activities	35	34.9
	None	14	19.2
Thigh Atrophy	Severe	1	1.4
	Slight	21	28.7
	None	51	69.9
Knee Flexion Deficiency	Severe	1	1.4
	Slight	22	30.1
	None	50	68.5

are needed. Increasing the duration of treatment to 8 weeks and increasing the sample size can produce better and more reliable results.

CONCLUSION

Our study concluded that patients' pain and functional outcomes significantly improved after receiving clam-shell exercise for six weeks. The pain was reduced between mild to moderate, and the functional outcome was improved to a moderate level. The greater the score on the Kujala Anterior Knee Pain Scale (AKPS), the better the functional outcomes.

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 made available upon request. The corresponding author will submit all dataset files.

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