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Effect of Mulligan's Pain Release Phenomenon on Pain, ROM and Functional Ability among the Subjects with Patellofemoral Pain Syndrome

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Abstract: ***Introduction: Patellofemoral pain syndrome (PFPS) involves discomfort around or behind the patella, exacerbated by weight-bearing activities like squatting, climbing stairs, or running. Contributing factors include lower extremity malalignment, muscular imbalance, quadriceps weakness, and overuse. Symptoms include gradual anterior knee pain, patellofemoral crepitus, knee stiffness, and restricted physical activity. Aim and Objectives: This study aims to evaluate the effect of Mulligan's pain release phenomenon (PRP) on pain, range of motion (ROM), and functional ability in PFPS patients. Pain was assessed using the NPRS score, ROM with a goniometer, and functional ability with the Lower Extremity Functional Scale (LEFS). Methodology: The study involved 30 subjects diagnosed with PFPS. ROM (flexion and extension) was measured by goniometer, pain was assessed via NPRS, and functional ability via LEFS. Subjects received PRP treatment for 4 weeks (12 sessions total, 30 minutes each, 3 times a week), with a home exercise program. Post-treatment values were recorded after 4 weeks. Results: Results showed significant improvements in knee ROM (P=0.000), LEFS (P=0.000), and NPRS (P=0.000). PRP effectively reduced pain and improved ROM and functional ability in PFPS patients. Conclusion: Mulligan's pain release phenomenon significantly improves pain, ROM, and functional ability in patients with PFPS.***

Keywords: Patellofemoral pain syndrome, mulligan pain release, pain relief, range of motion, functional ability

1. Introduction

Patellofemoral pain syndrome (PFPS), commonly seen in family medicine, sports medicine, and orthopaedics, is characterized by pain around the patella, often during high-loaded knee flexion and extension. It is also known as runner's knee or anterior knee pain syndrome. Activities like running, stair climbing, jumping, and squatting can exacerbate PFPS. The condition is associated with structural issues in the patellofemoral joint, such as discomfort during knee flexion and extension, joint crepitus, and instability[1,2,3] **.**PFPS can result from muscular imbalances, including decreased knee extensor strength, and an imbalance between the quadriceps, vastus medialis obliquus, and vastus lateralis. Hip muscle weakness also contributes to the condition, particularly in women. Overuse and increased physical activity levels, such as competitive sports, are significant risk factors. The pain typically occurs with loaded knee activities and can persist for years, leading to reduced physical activity and further joint loading.[4,5,6] **.**There is no definitive clinical test for PFPS, but anterior knee pain during squatting is commonly indicative. Other diagnostic features include altered patellofemoral morphology and muscle weaknesses. Radiographic evidence of osteoarthritis can indicate patellofemoral osteoarthritis.[7]**.** Physical therapy for PFPS includes strengthening the vastus medialis obliquus, balancing the kinetic chain, and using orthotic devices. Taping and bracing, especially McConnell's patellar taping, are common treatments that help improve knee function. Current rehabilitation also involves braces that apply medial force to the patella and promote patellar stability. Closed-chain exercises and low-impact aerobic activities are beneficial.[8,9] **.**PRP is a technique that uses pain-provoking manual force to isolate the pain source. It includes stretch, contraction, compression, and distraction methods, with each targeting different structures. PRP is known to reduce pain and increase pain-free range of motion, especially in chronic cases. Studies show significant reductions in muscle stiffness and disability.[10,11,12,13]

2. Review of Literature

Shrinivas Shinde et al. [11] also studied 50 subjects with chronic lateral epicondylitis and concluded that PRP significantly relieves pain and improves strength.

Radhika Chintamani [13] studied 50 subjects with subacute lateral epicondylitis and found that Mulligan's Pain Release Phenomenon (PRP) effectively reduces muscle stiffness, pain, and disability while improving strength.

Saeeda Taj et al. [14] compared Maitland Mobilization and PRP in 47 subjects with early knee osteoarthritis, finding both techniques equally effective in reducing pain, improving knee range of motion, and functional mobility.

Sana Shahid et al. [15] investigated 60 subjects with patellofemoral pain syndrome and concluded that PRP, combined with conventional treatment and home exercises, effectively reduces pain and improves knee function over six weeks.

Nikhil Bhosale et al. [16] studied 30 subjects with chronic patellofemoral osteoarthritis and found that PRP combined with Kinesio taping was more effective in reducing pain and improving function than other treatments.

Gosavi Akshay Babaji and Sandeep Babasaheb Shinde [17] studied 52 subjects with De Quervain's tenosynovitis and found that combination therapy (MDT + PRP + Conventional therapy) was most effective.

Dr. Rajashree Lad et al. [18] studied 32 subjects with De Quervain's tenosynovitis and concluded that PRP significantly improved pain and functional status.

3. Materials and Methodology

Methods

- **Study design:** Experimental study design.
- **Study setup:** College of physiotherapy SVIMS, BIRRD Hospital, Tirupathi.
- **Treatment duration:** 4 weeks.
- **Source of samples:** College of physiotherapy SVIMS, BIRRD Hospital, Tirupathi.
- **Sampling:** Simple random sampling.
- **Sample size:** 30
- **Study period:** 6 months

Materials:
Universal Goniometer, Low Couch, Lower Extremity Functional Scale

Inclusion Criteria
Patients who met the inclusion criteria X- RAY, with the confirmed diagnosis of patellofemoral pain (PFP) syndrome were encompassed in the study. Patients of either gender aged 35-55 years with insidious onset of anterior knee or retro-patellar pain of greater than six weeks' duration and provoked by at least two of prolonged sitting or kneeling, squatting, running, hopping, or stair walking; tenderness on palpation of the patella, or pain with step down or double leg squat and with positive provocation test for patella were considered. Subjects with unilateral PFPS were included.

Exclusion Criteria:
History of knee trauma. Infection around the knee. Rheumatoid Arthritis. Ligamentous injury. Knee joint hyper mobility. Inability to comply with the study protocol due to cognitive impairment were excluded from the study. Hip joint pathology.

Outcome Measures:
Pain by Numerical Pain Rating scale. ROM by Universal Goniometer. Functional abilities by Lower Extremity Functional scale.

Methodology:
An Informed consent was taken from all the willing subjects after explaining treatment protocol. A total of 30 subjects were recruited who met the inclusion criteria for the study. The pre-values of PAIN, ROM, LEFS were taken from all the subjects before the treatment protocol. All the subjects were given mulligan's pain release phenomenon and handouts were given to the subjects with detailed instructions and diagrammatic representation of home exercise programme and post values were taken after four weeks of treatment.

4. Protocol

Mulligans Pain Release Phenomenon
The pain release phenomenon technique is a technique pioneered by Brian Mulligan for management of pain. The Pain Release Phenomenon seeks to exert a manual force that is very slightly painful at its starting point of application, which can be a be a joint compression, joint compression with movement (physiological or accessory), a passive soft tissue stretch or an isometric muscle contraction that provokes the patient's pain. The amount of manual force that is applied with a PRP must comply with two fundamental rules: (1) pain must not exceed 4 on an 1 point numerical pain rating scale (NRS, where 0 = no pain and 10 = most severe pain imaginable); and (2) the pain must be 0 on that NRS within 20 seconds of its sustained application. If the pain diminishes to 0 prior to 20 seconds, more force is applied, but the pain must not exceed 4 on the NRS and it still diminishes to 0 within 20 seconds. If the pain does not diminish to 0 within 20 seconds, then less force can be applied in order to achieve this target. The PRP that follows the two fundamental rules is repeated until pain can no longer be elicited. The expectation is that this will occur within a treatment session and might manifest as higher force to provoke pain, earlier abolishment of pain and more difficult to elicit the patient's pain at outset. If a force level cannot be found to comply with these two fundamental rules, then the P R is not appropriate and should be discontinued. Each treatment session is of 30 minutes duration,1session per day, 3 days in a week for 4 weeks total of 12 sessions. Handouts were given to the subjects with detailed instructions and diagrammatic representation of home exercise programme, after four weeks of treatment the post values were taken.[10]

Pain Release Phenomenon for Patello Femoral Pain Syndrome
Subjects were instructed to lie supine on the treatment table with knee in extension position. Then the therapist places his

one hand on the superior aspect of knee and the other hand placed on posterior aspect of knee on the involved side. Then the compression force is given on the patella against the femoral condyles with one hand and the other will support in the posterior aspect. Following, the knee joint will be moved into flexion and repeatedly, until the subjects pain can no longer be elicited with the pain release phenomenon technique.[10,15]

After completing 4 weeks of intervention, the post-test values were recorded and sent for statistical analysis.

Images of Subjects Receiving the Treatment

Figure 1: Compression type of pain release phenomenon – extension

Figure 2: Compression type of pain release phenomenon - flexion

Figure 3: Measurement of knee flexion ROM using goniometer

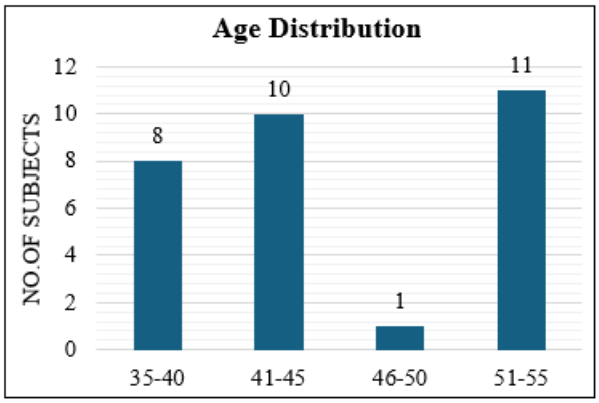
Figure 4: Measurement of knee extension ROM using goniometer

5. Results

The data is entered into Microsoft Excel for tabulation and analysis. Statistical analysis is carried out by using SPSS 25.0 version software. The Unpaired sample t-test is applied to compare the mean values of all the parameters in both the groups. A p-value of <0.01 will be considered as statistically significant.

Table 1: Categorization of Subjects according to Age Wise

Age (Years)	Group	
	No. of Subjects	%
35-40	8	26.66
41-45	10	33.33
46-50	1	3.33
51-55	11	36.66
Total	30	100
Mean Age	45±7.5	

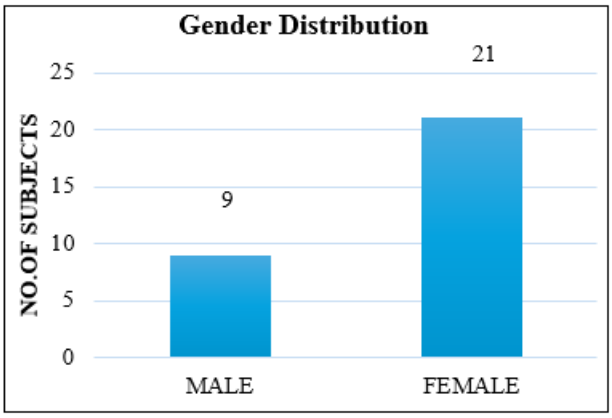


Graph 1: Categorization of Subjects according to Age Wise

Table and Graph 1 shows the mean age of subjects in the study that is 45±7.5.

Table 2: Categorization of Subjects According to Gender Wise

Gender	No. of Patients	
	No. of Subjects	%
Male	9	30
Female	21	70
Total	30	100

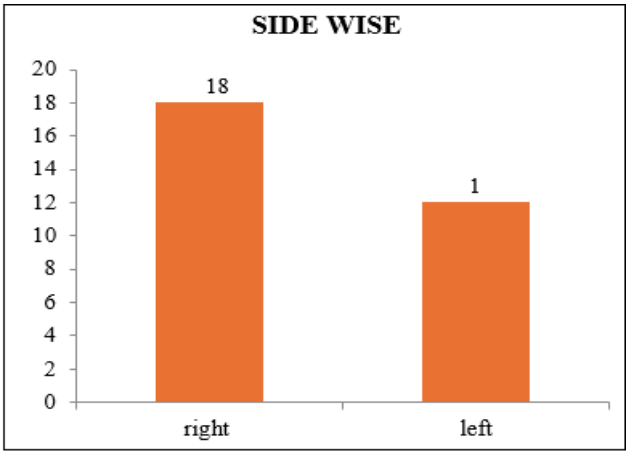


Graph 2: Categorization of Subjects according to Gender Wise

Table and Graph 2 shows among the total of 30 subjects,9 subjects were males and 21 subjects were females.

Table 3: Catogorisation of Subjects According to Side of PFPS

Side	No. of Subjects	%
Right	18	60
Left	12	40
Total	30	100

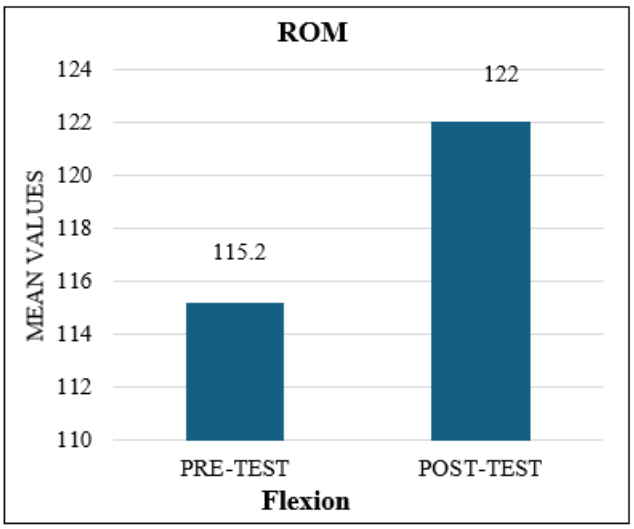


Graph 3: Catogorisation of Subjects according to Side of PFPS

Table 3 and graph 3 shows, among the 30 subjects, 18 subjects are of right side PFPS and 12 subjects are of left side PFPS

Table 4: Pre and Post-Test Mean Values of Knee ROM Flexion Before and After Treatment

	N	Pre-Test	Post-Test	Mean	t-Value
ROM Flexion		Mean ±S.D	Mean ± S.D	Difference	(P - Value)
	30	115.2±6.94	122.5±5.69	7.3	1.5788 (0.000)

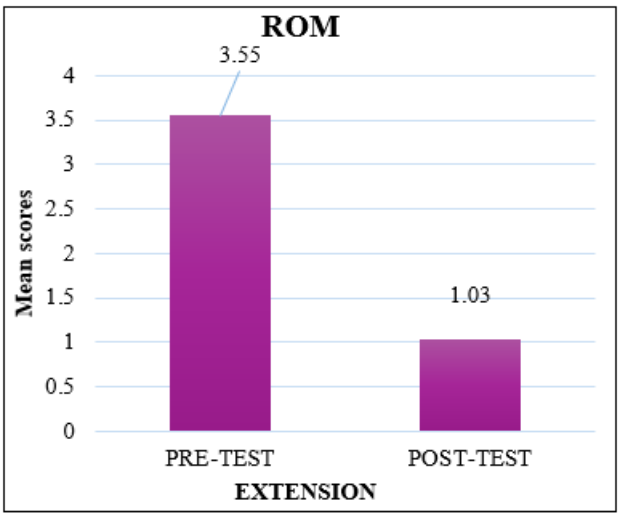


Graph 4: Pre and Post-Test Mean Values of Knee ROM Flexion Before and After Treatment

As P < 0.01, there is a significant difference within the pre and post treatment intervention of Flexion ROM.The mean pre-test value of Flexion 115.2±6.94 is altered to post-test mean value of 122.5±5.69 with a mean difference of 7.3.The paired t test value of Rom in flexion is 1.5788.The result revealed a t-value of flexion 1.5788 and a significance of 0.00, including that there is statistical significance with p-value < 0.001

Table 5: Pre and Post-Test Mean Values of Knee ROM Extension Before and After Treatment

	N	Pre-Test	Post-Test	Mean	t-Value
ROM Extension		Mean ±S.D	Mean ± S.D	Difference	(P - Value)
	30	3.55±1.40	1.03±0.565	2.52	2.8027 (0.000)

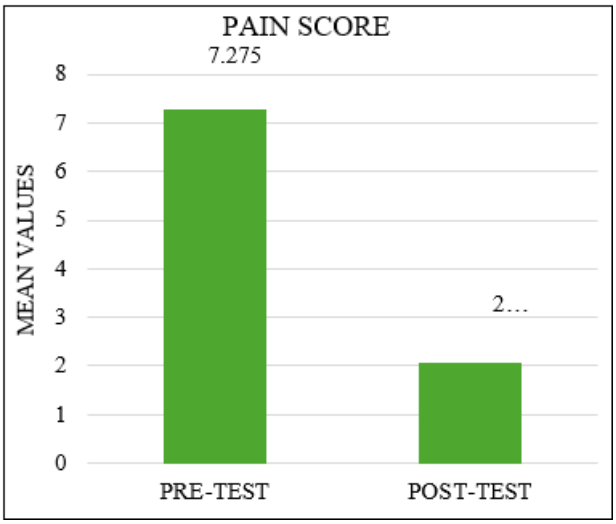


Graph 5: Pre and Post-Test Mean Values of Knee ROM Extension Before and After Treatment

As P < 0.01, there is a significant difference within the pre and post treatment intervention of Extension ROM.The mean pre-test value of Extension 3.55±1.40 altered to post-test mean value of 1.03±0.565 with a mean difference of 2.52.The paired t test value of Rom in flexion is 2.8027The result revealed a t-value of extension 2.8027 and a significance of 0.00, including that there is statistical significance with p-value < 0.001.

Table 6: Pre and Post-Test Mean Values of Pain Score Before and After Treatment.

	N	Pre-Test	Post-Test	Mean	t-Value
Pain Score		Mean ±S.D	Mean ± S.D	Difference	(P - Value)
	30	7.275±0.49	2.068±1.03	5.2068	3.197 (0.000)

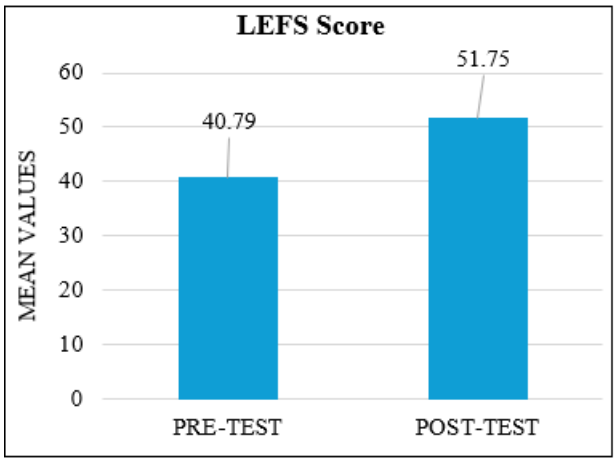


Graph 6: Pre and Post-Test Mean Values of Pain Score Before and After Treatment.

As P < 0.01, there is a significant difference within the pre and post treatment intervention of Pain.The mean value of pain in pre-test is 7.275±0.49 and post-test is 2.068±1.03 with mean difference of 5.2068 and t-value 3.917. The result revealed a t-value of 3.917 and a significance of 0.00, including that there is statistical significance with p-value < 0.001

Table 7: Pre and Post-Test Mean Values of Lefs Score Before and After Treatment

	N	Pre-Test	Post-Test	Mean	t-Value
LEFS Score		Mean ±S.D	Mean ± S.D	Difference	(P - Value)
	30	40.79±11.46	51.75±7.52	-10.655	2.64012 (0.000)



Graph 7: Pre and Post-Test Mean Values of Lefs Score Before and After Treatment.

As P < 0.01, there is a significant difference within the pre and post treatment intervention of functional activities. The mean value of LEFS in pre-test is 40.79± 11.46 and post-test is 51.75± 7.52 with mean difference of -10.655. The result revealed a t-value of 2.64012 and a significance of 0.00, including that there is statistical significance with p-value < 0.001

6. Discussion

Patellofemoral pain (also known as patellofemoral pain syndrome, runner's knee, or anterior knee pain) is a common condition, accounting for 11-17% of knee pain cases in general practice. While it typically affects active individuals under 40, it can occur at any age and activity level. This pain, often gradual and non-traumatic, is linked to activities that stress the patella, such as squatting, stair climbing, hiking, and running. With proper diagnosis and evidence-based treatments, patellofemoral pain can be managed to reduce pain and improve function, helping patients maintain an active lifestyle.[22]

Over a period of 6 months, a total of 37 subjects with patellofemoral pain syndrome were screened and included in the study. However, 7 subjects were excluded based on exclusion criteria (n=30). 30 subjects who met the inclusion criteria and willing to participate in the study were enrolled in the study. As this is a single group study all the 30 subjects received mulligans pain release phenomenon along with home exercise programme.

Chintamani R et al said that the The possible mechanism given behind Pain release phenomenon reducing the pain is by releasing endorphins and encephalins neurotransmitters; which causes pain inhibition. Definite disappearance of Neuronal plasticity that is central sensitization towards chronic pain occurs if the nociceptive input is decreased thus causing pain reduction, this theory can be correlated with PRP as it works with identical principle on creep effect. PRP techniques help in inducing the interfibral stretch within the muscles which helps in smooth gliding of the fascia over the muscle thus; reducing pain during daily activities thus improving overall functional ability. The Mulligan's Pain Release Phenomenon demonstrates significant reduction in muscle stiffness as the hold of stretch was for 10 seconds and the stretch was performed repeatedly [29].

Sana Shahid et al. studied 60 participants and found that combining the Pain Release Phenomenon (PRP) with conventional treatment and home exercises effectively reduced pain and improved knee function in patellofemoral pain syndrome over six weeks.[33] Radhika Chintamani's study on 50 subjects with subacute lateral epicondylitis showed that PRP reduces pain, muscle stiffness, and disability while improving strength.[29] Shrinivas Shinde et al. concluded that PRP significantly relieved pain and improved strength in chronic lateral epicondylitis.[27] Saeeda Taj et al. found Maitland Mobilization and PRP equally effective in reducing pain and improving range of motion and functional mobility in early knee osteoarthritis.[32] Nikhil Bhosale et al. found that PRP combined with Kinesio taping showed more improvement than conventional therapy in chronic patellofemoral osteoarthritis.[35] Gosavi Akshay Babaji and Sandeep Babasaheb Shinde concluded that a combination of McKenzie's Method, PRP, and conventional therapy was most effective in treating De Quervain's tenosynovitis.[37]

7. Conclusion

The present study concluded that the subjects who received Mulligans pain release phenomenon had shown more improvement in terms of pain, functional ability and ROM.So, our study found that Mulligans pain release phenomenon is an effective technique in reducing pain, improving ROM and functional ability in patients with patellofemoral pain syndrome. This study accepted alternate hypothesis and disproved null hypothesis.

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