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Research Paper

Effect of Hip Abductor Strengthening on Knee Disability in Patients with Patellofemoral Pain Syndrome

Medical Science

KEYWORDS : Patellofemoral pain syndrome, hip abductor strengthening exercises, Close chain kinetic semisquat quadriceps, Anterior Knee Pain Scale.

Benish Aslam	Lecturer, Department of Rehabilitation Sciences, Hamdard institute of Medical Sciences & Research (HIMSR), Jamia Hamdard, Hamdard University, New Delhi, India. Corresponding Author
Nishat Quddus	Assistant Professor, Department of Rehabilitation Sciences, Hamdard institute of Medical Sciences & Research (HIMSR), Jamia Hamdard, Hamdard University, New Delhi, India.
Supriya Bali	Senior Physiotherapist, Department of Physiotherapy, All India Institute of Medical Sciences (AIIMS), New Delhi, India.
Sohrab A. Khan	Assistant Professor, Department of Rehabilitation Sciences, Hamdard institute of Medical Sciences & Research (HIMSR), Jamia Hamdard, Hamdard University, New Delhi, India.
Deepak Malhotra	Assistant Professor, Department of Rehabilitation Sciences, Hamdard institute of Medical Sciences & Research (HIMSR), Jamia Hamdard, Hamdard University, New Delhi, India.

ABSTRACT

This paper talks about the effectiveness of hip abductor strengthening exercises on knee disability in patients with patellofemoral pain syndrome. The study was conducted on 30 patients with Patellofemoral Pain Syndrome at Physiotherapy Department, Majeedia Hospital, Jamia Hamdard; New Delhi, India. In the study; Group A (Experimental) received Conventional treatment of Patellofemoral Pain Syndrome (Close chain kinetic semisquat quadriceps strengthening protocol & Hip abductor Strengthening and Group B (Control) received only Close chain kinetic semisquat quadriceps strengthening protocol. The knee disability was measured using Anterior knee Pain Scale (AKPS). The addition of hip abductor strengthening to close chain kinetic semisquat exercises has shown greater improvement in the isometric strength and function as compared to using only close chain kinetic semisquat exercises over a 3 week period in Patellofemoral pain syndrome (PFPS) patients.

INTRODUCTION

Patellofemoral Pain Syndrome is indeed an "orthopaedic enigma" because its diagnosis is based on exclusion of other pathologies[1].It is also called a 'wastebasket' due to lack of a clear classification system. It is the second most common physical complaint presenting to physical therapists. It affects active adults (15-33%) & adolescents (21.45%)[2] and is more common in females (62% of cases) than males (38% of cases)[3]. Nearly 10% of all sports injury clinical visits by physically active individuals are due to PFPS4 with more than 2/3 of the patients being successfully treated through rehabilitation protocols [5,6,7]

It is said to have multi factorial etiology but the exact etiology and pathogenesis of patellofemoral pain syndrome is unknown. However, many predisposing factors have been proposed including trauma, overuse, immobilization, excessive weight, genetic predisposition, malalignment of the knee extensor mechanism, congenital anomalies of the patella, prolonged synovitis, recurrent hemorrhage into a joint, joint infection and repetitive intra-articular injection of corticosteroids. In many patients, there is no apparent reason for the symptoms.[8]

The onset is insidious and may occur bilaterally. Activities such as ascending or descending stairs, squatting, running, cycling, sitting with knees flexed for a prolonged period of time exacerbate the pain[9]. Also, there is a positive clinical patellar test (clarke's test or patellar femoral grinding test) and a positive eccentric step test[10]. The pain and disability resulting from this condition not only has short term effects on the performance of activities of daily living (ADL's) but 1 in 4 sufferers have long term implications upto 20 years after onset.[11]

Supervised exercise therapy for PFPS has been found to be more effective than "wait and see" approach and shows improvement in pain at rest as well as pain on activity and function.[9]

Deficits in hip muscle strength alters the lower extremity kinematics. Strengthening of hip abductor can overcome excessive hip adduction that is contributing to patellofemoral joint stress. Also, it prevents 'rolling in' of femur during early stance that has an adverse effect on the patellofemoral joint. Repetitive movements during functional activities within this malalignment overload patellar retinaculam and retro patellar articular cartilage and causes pain [12,13]

The ultimate goal is to return the patient to the highest functional level in the most efficient manner. Hence, if hip strengthening can be incorporated with the conventional treatment protocol of patients with patellofemoral pain syndrome can be determined that would improve the outcome of the physical therapy intervention on the patient. Treatment of the condition is necessary to avoid the effect of the condition on the performance of daily activities in non athletes as well as sport activities in athletes.

METHODS

A minimum of 15 subjects in each group was selected for the study on the basis of inclusion & exclusion criteria. The subjects were recruited from the Physiotherapy Department of Majeedia Hospital. The subjects were selected randomly according to the following criterion:

Inclusion Criteria:[9, 14]

1. Male/Female
2. Age group: 17-35 years
3. Presence of anterior or retro patellar knee pain during atleast 3 of following activities:
   - Ascending & descending stairs
   - Squatting
   - Running
   - Cycling
   - Sitting with knees flexed for prolonged period of time.
4. Positive eccentric step test10
5. Positive clarke's test 10

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6. Pain on palpation of the patellar facets
7. Insidious onset of symptoms unrelated to trauma
8. Persistence of symptoms for atleast 4 weeks

Exclusion Criteria: [9,14]

1. Recent Knee surgery/trauma (within 3 months)
2. Patellar dislocation/subluxation
3. Internal derangement of knee/meniscus pathology
4. Osgood Schlatter or Synding-Larsen Johansson syndrome
5. Ligamentous instability
6. Tibiofemoral osteoarthiritis
7. Infective condition like tuberculosis
8. Iliotibial band/Pes anserinus tenderness
9. Referred or radiating pain
10. Systemic disorder like renal conditions
11. Disabling ankle or hip joint pathology
12. Knee joint effusion

Procedure

After a screening examination, a detailed musculoskeletal assessment was carried out and subjects fulfilling the inclusion and exclusion criteria were included in the study. The informed consent was explained to the subjects and it was signed by them. Subjects were selected on the basis of samples of convenience and assigned into groups based on random assignment. The baseline measurements for knee disability on AKPS [15] were taken. Also, strength measurements for hip abductor were taken prior to the intervention. Strength measurements were taken using the strain gauge. Hip abductor strength was measured in supine lying position.The measurement obtained provided a measure of the isometric strength of hip abductor.

The conventional group was given a 3 week Close chain kinetic semi squat quadriceps strengthening protocol of 20 times twice a day. To perform the semi-squat exercise, the subject was asked to stand on the lower limb to be exercised and hold onto a stable surface using their hand, while the non exercise lower limb was in 90 degrees of hip and knee flexion. The subject was then ordered to flex the extended knee 15-20 degrees and hold this position for 3-4 seconds, then bring it to full extension and remain in this position for 3-4 seconds of rest. The number of repetitions was increased by 5 every 2 days, so by the end of the 21 day programme, the subject was performing 70 semi-squats twice a day.16 In addition to the above conventional regime of semi squat exercises, the experimental group was given a 3 week hip abductor strengthening protocol. This was done using elastic resistance bands (therabands) of different colour coding according to resistance. The exercises were done 3 times a week comprising of 3 sets, each having 10 repetitions. The elastic resistance was standardized to the maximum resistance that each subject was able to use and still complete 10 repetitions of the exercise. Resistance was also reviewed weekly for adequacy and increased according to the colour coding of therabands (yellow, red and green) depending on the resistance sustained by the subject.[17,18]

The measurements for knee disability on AKPS were taken after the intervention in each group after three weeks. Also, strength measurements for hip abductor were taken after the 3 week intervention

Results

30 patients were evaluated for the study. Their age, height, weight and BMI were recorded. The details of mean and standard deviation of these scores is given in table 1. The variables have no significant difference between the two groups.

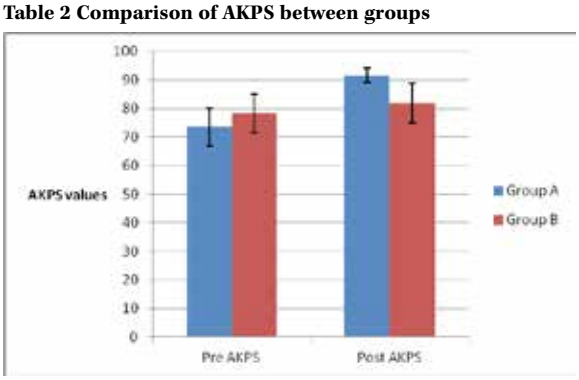
Group	Number of subjects	Age (Mean±SD)	Weight (Mean±SD)	Height (Mean±SD)	BMI (Mean±SD)
Group A	15	28.67±3.559	68.00±11.333	170.47±7.671	23.307±2.6937
Group B	15	26.07±3.240	61.27±8.754	165.00±9.644	22.453±2.1314

Table 1 showing mean and standard deviation of age, height, weight and BMI

On comparing the baseline reading (AKPS0) of both the groups, there was no statistically significant difference (0.926) between groups. However, on comparison of the readings after 3 weeks (AKPS3), a significant improvement (0.003) was noted between the two groups (Table 2). The difference has also been graphically depicted (Graph 1)

	Group A	Group B	Independent T-test	
	Mean±SD	Mean±SD	t value	Significance value
$AKPS_0$	73.5333±6.54508	78.3333±6.86260	-1.960	0.926
$AKPS_3$	91.6667±2.63674	82.000±6.92820	5.050	0.003

Table 2 Comparison of AKPS between groups

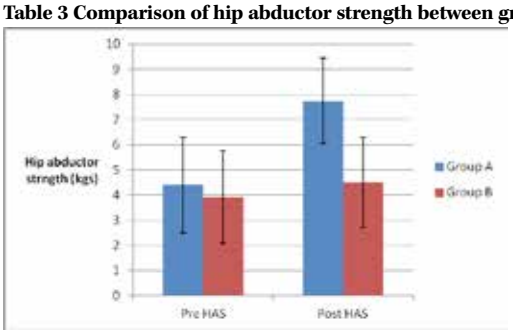


Graph 1 showing Comparison of AKPS between groups

The hip abductor strength was measured using a strain gauge on day 1 (baseline data as HAS0) and after 3 weeks of intervention (as HAS3). On comparing the baseline reading (HAS0) of both the groups, there was no statistically significant difference (0.485) between groups. However, on comparison of the readings after 3 weeks (HAS3), a significant improvement (0.000) was noted between the two groups (Table 3). The difference has also been graphically depicted (Graph 2)

	Group A	Group B	Independent T-test	
	Mean±SD	Mean±SD	t value	Significance value
HAS_0	4.4060±1.89600	3.9227±1.84032	0.708	0.485
HAS_3	7.7460±1.69669	4.5093±1.79386	5.077	0.000

Table 3 Comparison of hip abductor strength between groups



Graph 2 showing comparison of hip abductor strength between groups

Discussion

The purpose of the study was to assess the effectiveness of hip strengthening exercises for abductors on knee disability in patients with Patellofemoral Pain Syndrome (PFPS).The result of the study demonstrated that hip abductor strengthening in addition to closed chain kinetic semisquat exercises in the experimental group brought greater gains in all outcome measures including functional ability and isometric strength of hip abductor than the control group with closed chain kinetic semisquat exercises only.On comparison between the groups in the study, a statistically significant improvement was found in the experimental group on comparing the post intervention values of the control and experimental group. Hence, greater improvements in function using AKPS was obtained by incorporating a theraband hip abductor strengthening regime.

Hip abductors stabilize the pelvis in the frontal plane during ambulation. Hip abductors are active toward the end of the swing phase in preparation for heel contact. They are most active during the first 40% of the gait cycle especially during single limb support. Initially they act eccentrically to control the dropping of the pelvis to the side of the swing leg and then concentrically to initiate abduction in the later stance. In the frontal plane, hip abductors control the alignment of the femur in the frontal plane. Excessive adduction of the femur due to inadequate muscle activation produces an excessive valgus torque at the knee during stance phase. [19,20,21] Hence, weakness of hip abductors may affect lower extremity alignment during ambulation and incorporation of hip abductor strengthening is necessary for improving lower extremity kinematics during ambulation.

Relevance for clinical practice

Strength training may be useful in decreasing the time for rehabilitation. Also, incorporation of hip strengthening of abductors to close chain kinetic semi squat exercises would lead to greater improvement in function and strength of the muscles maximizing the recovery potential of PFPS patients.

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