

Effects of strengthening of hip abductors and lateral rotators for improving pain and functional limitation in patients with patellofemoral dysfunction

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Objective: To compare the effects of exercise program with and without hip muscles strengthening to improve pain & functional limitation in participants with patellofemoral dysfunction.

Methodology: It was a randomized controlled trial conducted from January to June 2017. The data were collected from The University Teaching Hospital, University of Lahore. A total of 30 participants with patellofemoral pain syndrome were randomly allocated into two groups by dice method. The Group-A (n=15) received hip muscles strengthening exercise along with conventional physiotherapy treatment whereas Group-B (n=15) received only conventional physiotherapy. Visual Analogue Scale and Kujala scale were used as outcome measure tools. 1st

reading was taken before treatment and 2nd and 3rd readings were taken after third and sixth week of treatment.

Results: The improvement in the score of visual analog scale in Group-A was 4.67 ± 0.97 and in Group-B was 3.00 ± 1.25 ($p=0.002$). The improvement in the score of Kujala scale was 41.00 ± 12.86 in Group-A and 30.06 ± 13.62 in Group-B ($p=0.03$).

Conclusion: Hip muscles strengthening exercise along with conventional physiotherapy was more effective than conventional physiotherapy for patient with patellofemoral dysfunction. (Rawal Med J 202;45:136-239).

Keywords: Anterior knee pain syndrome, muscle strength, patellofemoral pain syndrome.

INTRODUCTION

Patellofemoral dysfunction is the most widely recognized reason for lower limb pain.¹ It is thought to have prevalence of 7-26%, more common in youthful, dynamic females.^{2,3} The main factor involved in the development of patellofemoral dysfunction and malalignment of lower limb is weakness in the quadriceps muscles, hip abductors, external rotators and hip flexors.⁴ Customarily, this is the main focus because rehabilitation program has been on the improvement of the quadriceps muscles. Some of the literature supports the training of knee muscles especially promoting the timing and firing of the vastus medialis obliquus (VMO) in spite of some controversy.⁵ Generally, conservative treatment standards have in this manner concentrated essentially on quadriceps based training focusing on its strength, balance and timing especially VMO, and most of the time this strength training has been combined with other maneuvers such as flexibility training, use of tape, and

orthotics.^{6,7}

More recently, evidence has been shifted from quadriceps training alone to combined training of hip and knee muscles where all the muscles of hip joint are targeted.^{8,9} The rehabilitation regimes consisted of strengthening and development of control of the muscles around the hip joint in patellofemoral pain and dysfunction because low limb function is coordinated activity of all the muscles of lower quadrant especially hip muscles therefore it is vital to include training of hip muscles in the rehabilitation of patellofemoral pain syndrome.^{10,11} The purpose of the current study was to compare two interventions used in the management of patellofemoral dysfunction.

METHODOLOGY

It was randomized controlled trial which was conducted from January to June 2017 after taking approval from institutional ethical review board of the University. The data were collected from

Department of Physical Therapy of University Hospital. A total of 30 male and female patients aged 25-50 years, diagnosed with patellofemoral pain by orthopedic surgeon through clinical and radiological finding were recruited in the study. Those patients who had meniscal, ligamentous or any other intra-articular pathology, patients with recurrent subluxation, dislocation of the patella, past surgery of the knee joint, psychological or social issue red flags were excluded from the study. Participants were randomized into two homogeneous groups by dice method.

Conventional physiotherapy included 10 minutes ultrasonic therapy at pulsed mode, quadriceps strengthening and active short act extension exercises and proprioception training five days a week.¹² Participants in Group A received hip strengthening exercises along with conventional physiotherapy. Group-B received only conventional physiotherapy. Hip strengthening included 10 repetition of unilateral open chained resistive exercises of hip abductors and rotators with angle weights.¹³

The visual analogue scale (VAS; 0-10)¹⁴ and Kujala scale were used for the subjective measurements of knee pain and functional outcomes. Kujala scale is a 13-item self-report questionnaire that evaluates subjective responses to specific activities and symptoms that are thought to correlate with anterior knee pain syndrome. Total score of Kujala scale ranges from minimum score of 0 to a maximum score of 100 points. Lower scores indicate greater pain and disability.¹⁵ All patients were assessed three times i.e. before treatment, and at the end third week of treatment, and at the end of sixth week of treatment.

Statistical Analysis: The data were analyzed using SPSS version 21. The changes in scores of VAS & Kujala readings within the groups were explained with repeated measure ANOVA. Independent sample t test was used for the reading differences between groups. Statistical significance was set at $P=0.05$.

RESULTS

Out of 15 patients in Group A, 7(47%) were male and 8(53%) were females whereas in Group B, 6(33%) subjects were male and 9(67%) were

females. Mean age in group A was 36.73 ± 14.72 and in Group B was 31.33 ± 7.19 years. Subjects in both groups were also comparable in terms of weight, BMI, history of OA, effected side, dominant extremity, and smoking history. (p value; 0.42, 0.07, 0.71, 0.45, 0.27, 0.28, 0.62) (Table 1).

Table 1. Socio demographic comparison.

Variables		Group A with hip strengthening n=15	Group B without hip strengthening n=15	P- Value
Age(Years)		36.73±14.72	31.33±7.19	0.33
Weight (kg)		71.8±9.21	68.23±11.32	0.42
BMI		28.32±4.78	26.91±6.67	0.07
		Frequency	Frequency	
Gender	Male	7	6	0.71
	Female	8	9	
H/O osteoarthritis	Yes	8	10	0.45
	No	7	5	
More affected knee	Left	10	7	0.27
	Right	5	8	
Dominant extremity	Left	3	1	0.28
	Right	12	14	
H/O Smoking	Yes	2	3	0.62
	No	13	12	
DM	Yes	3	4	0.80
	No	12	12	

p - valve significant at ≤ 0.05

Table 2. Within Group comparison.

Outcome Measurement	Groups	Pre- treatment (Baseline)	During Treatment (3 week)	After treatment (6 week)	P- Value
Visual Analog Scale	Group A	5.93±0.799	3.67±1.45	1.27±0.59	<0.001*
	Group B	6.27±0.45	4.67±0.90	2.67±0.72	<0.001*
Kujala Scale	Group A	38.13±9.63	58.23±7.73	79.13±8.97	<0.001*
	Group B	39.20±8.49	49.20±8.41	69.27±9.28	<0.001*

*:the starred values are less than 0.001

Table 3. Between Group post treatment comparison at 6 week.

Outcome Measurement	GROUP A	Group B	P-Value
VAS Scale	4.67±0.97	3.00±1.25	0.002
Kujala Scale	41.00±12.86	30.06±13.62	0.032

p - valve significant at ≤ 0.05

The mean score of Group-A for VAS in pretest measurements was 5.93 ± 0.799 , during treatment was 3.67 ± 1.45 and after treatment was 1.27 ± 0.59 (<0.001) showing significant improvement with intervention of Group A. Mean VAS in Group B for

pretest readings was 6.27 ± 0.45 , during treatment was 4.67 ± 0.90 and in posttest reading was $2.67 \pm 0.72 (<0.001^*)$ showing significant improvement with the interventions of Group B. The mean score of Group A for Kujala Scale in pretest measurements was 38.13 ± 9.63 and after treatment was $79.13 \pm 8.97 (<0.001^*)$ showing significant improvement with intervention of Group A. Mean Kujala score in Group B for pretest readings was 39.20 ± 8.49 and in posttest reading was $69.27 \pm 9.28 (<0.001)$ showing significant improvement with the interventions Group B (Table 2 and 3).

DISCUSSION

There is less evidence regarding hypothesized strengthening of hip stabilizers in addition to quadriceps centered exercise rehabilitation program for patients with anterior knee pain and function.¹⁶ The findings of current study suggested that additional strengthening of hip extensors along with quadriceps is more beneficial for improving functional deficit and pain.

Although, prognostic factors measured at baseline showed the experimental group to be at slight disadvantage, yet the patients in this group performed significantly better than that of receiving quadriceps centered rehab program only. Those prognostic variables included age, body mass index and comorbid conditions such as history and onset of diabetes mellitus. In order to eliminate assessor bias, both outcome measures were self-evaluating. There found significant improvement at all post-interventional readings taken at 3rd and 6th week interval.^{1,2,7,17}

Majority of previous studies had focused on quadriceps centered strengthening program.¹⁷ Mostly treatment is not progressed to hip or lower joints and patients are discharge from plan of care. However, patients complain problematic function later.¹⁸ Additional resistance training of hip joint muscles is better than isolated quadriceps strengthening exercise.^{19,20}

The current study was different in terms of exercise type used for strengthening. In previous studies, mostly open chain exercises has been used either for isolated quadriceps centered strengthening program

or including hip muscles, however, current study incorporated strength training using various closed chain positions such as sitting and standing. The idea was to make exercise convenient for patients, so that they can use these exercises at home settings as well according to prescribed plan.²¹

Contrasts in current findings versus those of past experiments might be exercise type, intensity, type and time of intervention. Before this Fukuda et al combined open chain exercise program, for strength training of hip extensors, adductors, lateral/ medial rotators, and those of closed chain exercise program such as squats, seated knee extensions, leg presses and calf raise.²²

As lower limb function is the product of coordinated hip, knee and ankle stabilizers working in a synchrony, it is suggested for future reference that in case of injury to any of these regions, the rehab program should be holistic involving training of these three core regions, especially when the onset has past 6 months.

Result of this study should be interpreted by considering some limitations. The participants recruited for study represented narrow range of time. A larger and diverse, sample size should be utilized and the study duration should be longer.

CONCLUSION

Both interventions were found to be effective in reducing pain and functional limitations but hip strengthening along with conventional therapy was more effective as compared to conventional physiotherapy alone. Physiotherapists should apply hip strengthening exercises in patients with patella femoral pain to get optimal results

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