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ORIGINAL ARTICLE

"Comparison of Specific Hip Strengthening Exercises and Conventional Knee Exercises on Pain, Muscle Strength and Function in Sprinters with Patello-Femoral Pain Syndrome"

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ABSTRACT

Objective: The aim of this study is to compare the effects of strengthening exercises of Hip and conventional Knee exercises on pain, muscle strength and functional status in sprinters with Patello femoral pain syndrome

Methodology: A randomized controlled trial was performed on 28 sprinters. Participants were selected through non-probability convenient sampling. The study was single blinded and was completed in 6 months. The assessor was unaware of the treatment given to both groups. Group 1 received Conventional knee exercises and weight bearing hip strengthening exercises and Group 2 received traditional knee exercises and strengthening exercises of hip with resistance. All Exercises were performed with 12 reps and 3 sets, 3 times a week for 6 weeks. Numeric Pain Rating Scale (NPRS) for pain, AKPS (anterior knee pain scale) for functional status and make test applied through hand held dynamometer measured strength through contractions of knee muscles.

Results: The mean age of individuals in interventional group is 22.79 ±4.28 and the individuals in control group is 24.07 ±4.51. Both groups showed significant improvements in pain, function and muscle strength with $p<0.05$. There were not any significant changes in both groups with $p>0.05$.

Conclusion: Both interventions are equally effective in reducing pain, improving strength and function in sprinters with PFPS which showed that these interventions can be included in the rehabilitation plan of these athletes.

Keywords: Knee pain, Runners, Strengthening exercises, Rehabilitation exercises, strength

INTRODUCTION

According to a report, knee injuries related to sports are mostly due to Patellofemoral Pain Syndrome (PFPS) which is around 25% affecting almost young population aged between 15- 30 years and it is more common in female (20%) than male (7%) (1). Previous studies have shown that it is the most common orthopedic and musculoskeletal condition in energetic youth, affecting around 26% of sports person. The definition of PFPS according to a disclosure is the discomfort that occurs surrounding the patella and is increased or irritated by activities which involve continuous knee flexion and extension in weight bearing condition that loads the patella. It usually aggravates during activities like running, jumping, squatting and ascending and descending stairs. Its pain is mostly anterior, around & behind the patella with clicking sounds and patellar malalignment. It is usually a result of overuse (2).

Patient usually has a feeling of giving away or instability due to quadriceps weakness (3-5) .

With appropriate exercise prescription PFPS can be managed efficiently. Exercise prescription is an evidence-based treatment protocol[6-8].

Combinations of conservative treatments such as targeted exercise therapy can be used as an ideal treatment for PFPS which should be based on individualized risk factors identified in each patient[8, 9].

There has been a lot of studies conducted to see the effects of strength training programs including hip and knee on general patients but there is very less literature available on the studies conducted on athletes specifically Sprinters. Moreover, mostly studies include only females to study patellofemoral pain syndrome. The objective of this study is to differentiate the results of resisted exercises program of hip with standardized knee strengthening exercises on pain, muscle strength and function in Sprinters in both genders. Furthermore, findings from this study will definitely help future sports physiotherapists in prescribing specific and effective exercise plan, and this will save energy and time of both therapist and athlete. Additionally, with early management of pain and muscle strength, sprinters will return to their games early.(10)

MATERIALS AND METHODS

Data was collected from Pakistan Sports Board. It was a single blinded randomized controlled trial which was completed in 6 months. Research & Ethics Committee of Riphah College of Rehabilitation & Allied Health Sciences reviewed the study first and then gave permission for commencing this study. Informed and signed consent was taken in Urdu and English languages from each participant before commencing the study. For this study, the total sample size was 28 which was calculated from means of previous study using Epitool software (9). The sample was randomly divided in to two groups, Control group and Interventional group each group containing 14 subjects. This study recruited both male and female sprinters with the age range of 15-30 years, people with positive patellar compression test, sprinters having anterior knee pain for least 1 month, muscle strength for quadriceps, hamstring, gluteus Medius and gluteus maximus should be grade 3 on Manual Muscle Testing (MMT), pain increasing during any of the prescribed two activities such as climbing stairs, squatting, jumping, kneeling, running, jogging, and average pain score of 3 or more on Numerical pain rating scale(NPRS). This study excluded any participant with injury to lumber region, hip, knee or ankle, osteoarthritis or rheumatoid arthritis, patellar Instability, dislocation or subluxation, meniscal injury, any recent knee surgery (within 2-3 months), patellar tendon pathology & referred pain from spine.

On first day before applying intervention, an independent assessor who was unaware about participants' group allocations evaluated pain on Numeric Pain Rating Scale (NPRS) while patient was ascending and descending a 25 cm step, muscle strength through hand held dynamometer by using make test method in which assessor held the dynamometer in hand and patient applied contractions to assessor's hand holding dynamometer and the function level of knee on AKPS (Anterior Knee Pain Scale) and marked the values. Conventional knee exercises were same for

both groups as a baseline treatment. All the exercises were instructed to perform for 12 repetitions and 3 sets. The participants in each Group performed all the exercises 3 times a week for consecutive 6 weeks on alternate days. After 6 weeks, sprinters were reexamined by measuring their pain intensity, muscle strength and functional status of knee and their measurements were recorded as post intervention measurements.

Group 1 (control) was given conventional knee exercises and weight bearing hip strengthening exercises. Conventional knee exercises were half squats, seated knee extension on each side, knee flexion on each side in prone lying, leg calf raises and all for 10 repetitions & 3 sets a day. Stretching for quadriceps, hamstring, & Ilio-tibial band (3 repetitions with 15 sec holds for 3 sets) [8]. Weight bearing hip strengthening exercises were single leg Glute bridge, hip extension with knee flexion in quadruped position on shoulders, hip extension with knee extension in quadruped position on shoulder, side lying hip abduction. All exercises were performed 3 times a week on alternate days for 6 weeks. All outcome measures were recorded before intervention and 6 weeks after intervention.

Group 2 (interventional) was given conventional knee exercises and strengthening exercises of hip with resistance. Conventional knee exercises were same as above (9). Hip strengthening exercises with resistance included all the weight bearing exercises as above mentioned but with the addition of resistance through Thera band/ loop band.

Data was analyzed using IBM SPSS Statistic 21. Shapiro-Wilk test showed that data was normally distributed with $p>0.05$. Independent sample t-test was used to compared both groups and one sample t-test was used for measuring changes in pre & post treatment values of both groups.

RESULTS

Table 1 shows clinical & demographic differences of both groups at baseline. Both groups were similar at baseline.

Table 1: Clinical & Demographic Data of study

Sr.no	Variables	Group	Mean	Standard Deviation
1	Age	Interventional	22.79	4.28
		Control	24.07	4.51
2	Numeric Pain Rating Scale	Interventional	6.14	1.70
		Control	6.07	1.73
3	Quadriceps Strength	Interventional	32.43	3.81
		Control	34.43	4.89
4	Hamstring Strength	Interventional	31.71	5.12
		Control	32.071	4.89
5	Gluteus Medius Strength	Interventional	13.57	1.82
		Control	14.29	2.16
6	Gluteus Maximus Strength	Interventional	20.07	2.99
		Control	19.93	2.89
7	Anterior Knee Pain Scale score	Interventional	65.43	21.52
		Control	65.29	22.53

Table 2 shows that both groups showed non-significant changes with $p>0.05$ in improving pain, functionality & strength of knee after application of both techniques

Table 2: Between group comparison of control & interventional groups after application of both techniques using Independent Sample t-test

Sr.no	Variables	Group	Mean	St. Deviation	P value
1	Numeric Pain Rating Scale	Interventional	1.71	1.06	0.91
		Control	2.28	1.54	
2	Quadriceps Strength	Interventional	33.85	3.73	0.23
		Control	35.64	5.06	
3	Hamstring Strength	Interventional	33.00	4.55	0.85
		Control	33.14	4.86	
4	Gluteus Medius Strength	Interventional	14.78	1.42	0.35
		Control	15.50	1.45	
5	Gluteus Maximus Strength	Interventional	21.42	2.73	0.89
		Control	21.50	3.00	
6	Anterior Knee Pain Scale score	Interventional	92.14	5.12	0.98
		Control	91.57	7.65	

Table 3 shows within group changes in interventional & control groups by using one-sample t-test and it clearly demonstrates that for interventional group as well as control group $p<0.05$ in cases of pain, functional levels & strength of knee. This means both groups showed significant within group changes when pre and post treatment levels were compared.

Table 3: With in group changes using one-sample t-test

Sr.no	Variables	Within Group	P-Value
1	Numeric Pain Rating Scale (interventional)	Pre-treatment	0.002
		Post-treatment	
2	Quadriceps Strength (interventional)	Pre-treatment	< 0.001
		Post-treatment	
3	Hamstring Strength(interventional)	Pre-treatment	< 0.001
		Post-treatment	
4	Gluteus Medius Strength(interventional)	Pre-treatment	<0.001
		Post-treatment	
5	Gluteus Maximus Strength(interventional)	Pre-treatment	<0.001
		Post-treatment	
6	Anterior Knee Pain Scale score(interventional)	Pre-treatment	0.001
		Post-treatment	

7	Numeric Pain Rating Scale (control)	Pre-treatment	<0.001
		Post-treatment	
8	Quadriceps Strength (control)	Pre-treatment	< 0.001
		Post-treatment	
9	Hamstring Strength(control)	Pre-treatment	< 0.001
		Post-treatment	
10	Gluteus Medius Strength(control)	Pre-treatment	0.001
		Post-treatment	
11	Gluteus Maximus Strength(control)	Pre-treatment	<0.001
		Post-treatment	
12	Anterior Knee Pain Scale score(control)	Pre-treatment	<0.001
		Post-treatment	

DISCUSSION

The goal of this research was to evaluate the effects of strengthening exercises in sprinters with PFPS. Both groups showed significant improvement after treatment in managing pain, improvement in muscle strength and knee but if we considered mean values and p values among two groups then it revealed that both the interventional and control group are equally effective in improving pain, function & strengths of knee in patella-femoral pain syndrome.

A systematic review conducted in 2018 by Cara Elliot et al. concluded that strengthening exercise of hip in addition to standardized treatment including knee strengthening and stretching exercises had excellent treatment effects in improving pain and function in adults with patella-femoral pain syndrome with $p<0.05$(9) . This study is in agreement with current study's results that these exercises have impact in improving pain and function with $p<0.05$ over a period of 6 weeks in sprinters with PFPS. Another Randomized control trial was conducted with crossover design in 2021 by A. Jellad et al. proved that strengthening exercises of external rotators of hip in addition with stretching exercises are effective in reducing pain and improving function in persons with PFPS with $p<0.05$(11). This RCT is in partial agreement with current study's conclusion that showed both groups were equally effective in improving pain and functions of knee. An RCT conducted in 2021 showed that hip strengthening exercises have no significant effect on improving pain, strength and function(12) . On contrary this study showed improvements in NPRS and AKPS. This study faced financial constraints and limited time was available for this study so this study only included athletes from one sports center only. It is recommended for future researchers to conduct more studies with specifically targeting PFPS in other athletic populations as well and with varying frequency, intensity & duration of exercises.

CONCLUSION

In the end, it is deduced from this study that combination of knee strengthening & conventional knee exercises is equally effective in improving pain, functional level and strength of knee in sprinters with PFPS when compared with combination of traditional knee exercises & knee weight bearing exercises.

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