EFFECTIVENESS OF HIP STRENGTHENING WITH CORE STABILIZATION VERSUS KNEE STRENGTHENING IN IMPROVING PAIN AND FUNCTION IN PATIENTS WITH PATELLOFEMORAL PAIN SYNDROME.

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EXAMINERS

1.

2.

A PROJECT SUBMITTED TO

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Masters of Physiotherapy

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CERTIFICATE

This is to certify that the project title "EFFECTIVENESS OF HIP STRENGTHENING WITH CORE STABILIZATION VERSUS KNEE STRENGTHENING IN IMPROVING PAIN AND FUNCTION IN PATIENTS WITH PATELLOFEMORAL PAIN SYNDROME" is a bonafide record done under my guidance supervision in the partial fulfillment for the degree of **MASTER OF PHYSIOTHERAPY (MPT II YEAR – APRIL 2016)** by Ms.. DIVYA. M **(Register Number: 271410226)** Post Graduate Student of Madha College of Physiotherapy.

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I express my gratitude to **MY GOD ALMIGHTY** for his abundant grace and mercy that has made me success in my life.

I would like to dedicate this project to my beloved husband.

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INTRODUCTION

Patellofemoral pain syndrome is one of the commonest knee pain syndromes seen in the physical therapy outpatient clinic. Patellofemoral pain syndrome (PFPS) is a syndrome characterized by knee pain ranging from severe to mild discomfort seemingly originating from the contact of the posterior surface of the patella (back of the kneecap) with the femur (thigh bone).[1]

The main symptom of Patellofemoral pain syndrome is knee pain, especially when sitting with bent knees, squatting, jumping, or using the stairs (especially going down stairs).Occasional knee buckling is experienced in which the knee suddenly and unexpectedly gives way and does not support the body weight.

The reported incidence of Patellofemoral problems in the clinical setting ranges from 21 to 40%.Patellofemoral-related problems occur twice as often in females as in males.[2]

The etiology of this condition remains unknown, although many intrinsic and extrinsic factors have been suggested .Commonly accepted hypothesis for etiology of Patellofemoral pain syndrome is based on excessive Patellofemoral joint pressure secondary to poor patellar tracking.[3,4]

Thus a variety of conservative treatments have been suggested, including quadriceps strengthening, patellar taping, stretching and bio-feedback. Nevertheless, no single intervention has been shown to be the most effective and the results of these treatment approaches have been mixed.[5,6, 7]

Recently, Patellofemoral pain syndrome was proposed to be related to reduce hip strength and core endurance. Poor hip control may lead to abnormal patellar tracking, increasing Patellofemoral joint stress and causing wear on the articular cartilage, especially poor eccentric hip abductors and lateral rotators muscles control can result in femoral adduction and medial rotation during weight-bearing activities, leading to a predisposition to lateral patellar tracking as the femur medially rotates underneath the patella.[8-14]

With this in mind, a possible treatment for the Patellofemoral pain syndrome could include optimizing hip abductors and lateral rotators muscle function to control these femur motions and prevent or reduce greater lateral forces acting on the patella.

It is also desirable to preserve or increase the trunk and pelvis musculature, since a lack of control of these musculatures may cause excessive anterior pelvic tilt, which may lead to femoral medial rotation.[15]

Mascal et al. reported on two patients with Patellofemoral pain who were treated with exercises focused on the recruitment and endurance training of the hip, pelvis and trunk musculature. After 14 weeks of treatment, both patients experienced significant improvement in their pain symptoms, function and in force production by the gluteus mediums and gluteus Maximus muscles.[16]

Fukuda et al conducted an RCT on 54 females with PFP to determine whether the addition of hip-muscle strengthening to a more traditional program of knee-muscle stretching and strengthening resulted in better outcomes than the knee program alone.

They reported that the addition of the hip-muscle–strengthening exercises resulted in better improvements in pain and function than did a knee-focused rehabilitation program. However, those study involved sedentary females, and the rehabilitation protocol lasted only 4 weeks, whereas at least 6 weeks of rehabilitation may be necessary to gain the greatest treatment effect.[17]

Ismail et al conducted an RCT to investigate the effect of adding hip-muscle strengthening to a squatting, step-up, and knee-extension protocol for 32patients with PFP. At the end of the 6-week protocol, the group that performed the additional hip strengthening reported greater improvements in pain control during Functional activities than did the control group.[18]

Prior researchers have identified several risk factors for the increased incidence of PFPS injuries in female athletes including the lack of core strength, proximal hip muscle weakness, and lower extremity proprioception/balance deficits.

Furthermore, core stability is necessary in order to provide a stable base for lower kinetic chain motion. Core stability is defined as the foundation of trunk dynamic control that allows the production, transfer, and control of force and motion to the terminal segments of the lower body kinetic chain.

The transverse abdominis (TA) is the first muscle activated during lower extremity movements, indicating that it is the primary muscle linked to core stability during lower limb movements. Core strength (CS) is considered important because it provides proximal stability for distal mobility during athletic tasks. Core strength has been measured in prior research using the Bent Knee Lowering Test (BKLT) in conjunction with abdominal hollowing in order to actively contract and isolate the TA.

The relationship between Core Strength and the lower extremity has been identified as a potential cause of overall lower extremity functional instability in females. Zazulak et al demonstrated that decreased core proprioception and neuromuscular control was a predictor of knee injury risk in female athletes. However, the term "core" is often used interchangeably with hip strength. Several authors have examined the relationship of muscle weakness in the hip rather than the true abdominal musculature with lower extremity injury risk. Overall prior researchers note that hip musculature provides a key element of stability to the knee complex, with the ability to reduce Patellofemoral injuries.[19, 20]

Considering the above, there are few studies focused on the role of the hip musculature in the treatment of the Patellofemoral pain syndrome. Thus, although the findings of previous studies suggest that including hip- and core muscle strengthening is beneficial to PFP outcomes, no authors have directly compared a hip-corefocused rehabilitation program with a knee-focused rehabilitation program for PFP.

No study has compared a rehabilitation protocol focused on strengthening of the hip abductors, lateral rotators musculature with transverse abdominis activation and strengthening of quadriceps treatment approach, to evaluate if there is some additional benefit.

Although the hip abductors and lateral rotators muscles act eccentrically to prevent femur adduction and medial rotation during weight-bearing functional activity, no study has evaluated eccentric hip muscle torque in patients with Patellofemoral pain.

Therefore, the purpose of this study was to investigate the influence of strengthening hip and core musculature on pain and functions of patients with Patellofemoral pain syndrome.

AIM OF THE STUDY

The main aim of the study is to investigate the influence of strengthening the Hip Abductors, Lateral rotators with Transverse Abdominis activation on Pain and Functional ability of patients with Patellofemoral pain syndrome (PFPS).

NEED OF THE STUDY

The purpose of the study was to compare pain and functional ability for the patients with PFPS assigned to either a hip-core focused (HIP) or a knee-focused (KNEE) 6-weekrehabilitation protocol.

OBJECTIVE OF THE STUDY

1. To determine the effects of hip abductors and lateral rotators strengthening with transverse abdominis activation in relieving pain and improving functional performance in subjects with Patellofemoral pain syndrome.
2. To determine the effects of quadriceps strengthening in relieving pain and improving functional performance in subjects with Patellofemoral pain syndrome.
3. To determine if patients with Patellofemoral pain syndrome(PFPS) who perform hip and core strengthening demonstrate greater improvements than the patients who perform knee strengthening.

OPERATIONAL DEFINITIONS

Patellofemoral pain syndrome:

Patellofemoral pain syndrome (PFPS) is a syndrome characterized by pain or discomfort seemingly originating from the contact of the posterior surface of the patella (back of the kneecap) with the femur (thigh bone).

Strengthening:

Muscle strengthening is defined as the ability of a muscle group to develop maximal contractile force against a resistance in a single contraction.

Resistance bands:

Resistance bands are a great addition to any strength training routine or rehabilitation program and come in a variety of sizes, lengths, and strengths.

Core stability:

"Core stability" describes the ability to control the position and movement of the central portion of the body. Core stability training targets the muscles deep within the abdomen which connect to the spine, pelvis and shoulders, which assist in the maintenance of good posture and provide the foundation for all arm and leg movements.

HYPOTHESIS

ALTERNATIVE HYPOTHESIS

There will be significant difference in relieving pain and improving functional performance following hip and core strengthening on subjects with Patellofemoral pain syndrome.

NULL HYPOTHESIS

There will not be significant difference in relieving pain and functional performance following hip and core strengthening on subjects with Patellofemoral pain syndrome.

REVIEW OF LITERATURE

1. H Collado, M Fredericson (2010) :

Patellofemoral pain (PFP) syndrome is a frequently encountered overuse disorder that involves the Patellofemoral region and often presents as anterior knee pain

2. Boling M, paduda D(2010) :

Conducted a study to investigate gender differences in the incidence and prevalence of Patellofemoral pain syndrome and concluded that gender was a significant predictor of development of PFPS with females being 2.23 times likely to develop PFPS than males

3.Cristopher M.Powers(1998) :

Conducted a study to investigate the rehabilitation of Patellofemoral joint disorders. The study article reviewed the current literature concerning the treatment of Patellofemoral pain with respect to vastus medialis oblique, taping, bracing and various forms of exercises.

4.Kimberly L. Dolak, Carrie Silkman. et all (2011) :

Performed a randomized clinical trial on 33 females to determine hip strengthening prior to functional exercises demonstrate greater improvement than quadriceps strengthening and concluded that initial hip strengthening allow an earlier dissipation of pain than exercises focused on quadriceps.

5.Thiago Yukio Fukuda,et all (2010) :

Performed a randomized clinical trial on 70 females to investigate the influence of strengthening hip abductors and lateral rotators on pain and function of females with PFPS and concluded that Rehabilitation programs focusing on knee strengthening exercises and knee strengthening exercises supplemented by hip strengthening exercises were both effective in improving function and reducing pain in sedentary women with PFPS. Improvements of pain and function were greater for the group that performed the combined hip and knee strengthening exercises.

6. Catherine L. Mascal, et all (2013) :

Presented two case reports to describe an alternative treatment approach for Patellofemoral pain that includes the assessment and treatment of the hip, pelvis, and trunk musculature should be considered in the rehabilitation of patients who present with Patellofemoral pain and other abnormal lower-extremity kinematics.

7.Theresa helissa, Thiago batista (2008) :

Conducted a randomized pilot trial to study the effect of additional strengthening of hip abductors and lateral rotators in strengthening quadriceps exercise program and concluded that it provide additional benefit in PFPS after 6 weeks of treatment.

8.Erik P Meira , pt ,Jason brumitt (2011) :

Conducted a study to assess hip strength and lower extremity kinematics in relation to PFPS. The result was that there is a link between hip strength and position of hip and Patellofemoral pain syndrome and has stated that hip strengthening and coordination program will be useful in conservative treatment of Patellofemoral pain syndrome.

9.Edith M Heintjes, Marjolein Berger, Sita MA Bierma-Zeinstra, Roos MD Bernsen

Conducted a study to summarize the evidence of effectiveness of exercise therapy in reducing anterior knee pain and improving knee function in patients with PFPS and concluded that the evidence that exercise therapy is more effective in treating PFPS than no exercise was limited with respect to pain reduction, and conflicting with respect to functional improvement. There is strong evidence that open and closed kinetic chain exercise are equally effective.

10.Earl JE,Hoch AZ(2010) :

Conducted a case series to determine changes in hip strength core endurance, lower extremity biomechanics focusing rehabilitation for Patellofemoral pain syndrome and concluded that there is a significant improvement in pain and function ability by focusing on hip and core strengthening.

11.Venu Akuthota,MD,Scott F.Nadler(2004) :

Conducted a study to understand the concepts of core strengthening and concluded that core strengthening has a theoretical basis in treatment and prevention of various musculoskeletal conditions.

12.Cynthiaj.watson, micahpropps (2005) :

Conducted a prospective methodological study to determine test-retest reliability and responsiveness of Anterior Knee Pain Scale (AKPS) and concluded that AKPS demonstrated high test-retest reliability and appear to be moderately responsive to clinical change in patients with anterior knee pain.

13.Kay M Crossley, Kim L Bennell (2004) :

Conducted an RCT on 70 participants to examine the test-retest reliability, validity and responsiveness of Anterior Knee Pain Scale in the treatment of Patellofemoral pain syndrome and concluded that AKPS is reliable and valid and recommended for future clinical trials.

14.Hossein Neghabhan, Mohammadpouretezad (2012) :

Investigated the validation of functional index questionnaire in patients with Patellofemoral pain syndrome and concluded that Functional index questionnaire is a valid and reliable outcome measures of functional limitation suitable for use in clinical practice.

15.David A. Lake, Nancy Wofford(2011) :

Conducted a study to determine the effectiveness of therapeutic modalities for the treatment of patients with PFPS and concluded that none of the therapeutic modalities reviewed has sound scientific justification for the treatment of PFPS when used alone.

DESIGN AND METHODOLOGY

STUDY DESIGN:

Randomized controlled clinical trial

STUDY SET UP:

- Madha Medical college and Hospital
- Deepam Hospitals
- Prema physiotherapy clinic

POPULATION:

All the well oriented and well co-operative lateral subjects with Patellofemoral pain who fulfils the inclusion criteria were included in the study.

SAMPLE SIZE:

30 subjects from the population were selected through the lottery method and they were divided into two groups (Each fifteen)

Group A : Knee protocol

Group B : Hip and core protocol

INCLUSION CRITERIA

- Subjects with the age of 25-35.
- Both female and male.
- Subjects with unilateral involvement.
- Visual analog score rating of pain in the anterior knee during activities of daily living during the previous week at a minimum of 3 cm on a 10-cm scale.
- Insidious onset of symptoms unrelated to trauma and persistent for at least 4 wk

- Pain in the anterior knee associated with the below criteria:
    1. During or after activity
    2. Prolonged sitting
    3. Stair ascent or descent
    4. Squatting
- Patellar grind test ‘positive’
- Pain with palpation of the patellar facets or pain during step down from a 20-cm box or during a double-legged squat
- Recreationally active (_30 min/d, 3–4 d/wk for the past 6 months and exclusive of pain)

EXCLUSION CRITERIA

- Meniscal or other intra-articular injury
- Cruciate or collateral ligament laxity or tenderness
- Patellar tendon, iliotibial band, or pes anserine tenderness
- Positive patellar-apprehension sign
- Evidence of effusion
- Hip or lumbar referred pain
- History of recurrent patellar subluxation or dislocation
- History of surgery to the knee joint
- Non-steroidal anti-inflammatory drug or corticosteroid use within 24 hours before testing
- History of head injury or vestibular disorder within the last 6months

VARIABLES OF THE STUDY

INDEPENDENT VARIABLE

1. Knee strengthening
2. Hip and core strengthening

DEPENDENT VARIABLE

1. Pain
2. Functional performance

MEASUREMENT TOOLS

1. Anterior knee pain scale
2. Functional index questionnaire

DURATION OF THE STUDY

- Patients with PFP were randomly assigned to a 6-week KNEE or HIP protocol.

METHODOLOGY

The purpose of the study is to hypothesize improvement in outcome measures for patients with Patellofemoral pain involved in Hip protocol would be greater than those in Knee protocol.

Participant involved in the study have insidious onset with no discernable cause other than overuse.

Patients were included after initial assessment. Subject who fulfills inclusion criteria will be assigned in two groups based on random sampling method.

Pre-test evaluation will be done before starting treatment including pain assessment using Anterior knee pain scale (AKPS) and functional index Questionnaire (FIQ)

Group-A

Patients in Knee protocol group initially performed non-weight bearing quadriceps strengthening exercise and then progressed to weight bearing exercise as in Appendix 1 .Post test evaluation will be taken after 6 week protocol.

ISOMETRIC KNEE SETTING

DOUBLE LEGGED ONE QUARTER SQUAT

GROUP-B

Patients Received Hip-Protocol involving Hip Abductors and Lateral rotators strengthening with core stabilization by activating Transverse abdominis.

Before giving the intervention the pre-test score of pain and functional performance were taken.

Patients with Patellofemoral pain in Hip-protocol group initially performed non-weight bearing muscle strengthening exercise focused on activating hip musculatures.

Those exercises progressed to weight bearing exercise including core strengthening and balancing exercise designed to target core muscles that emphasized stabilizing core muscle by activating transverse abdominis before initiating the movement as in Appendix 2.

Transverse Abdominis activation is done by contracting pelvic floor by drawing the muscles from behind pubic bone to tail bone and the left and right sides of pelvic floor together and then like a draw string bag, gently draw the entire pelvic floor up.

Posttest evaluation will be done after 6weeks of the protocol.

HIP ABDUCTION IN STANDING

HIP EXTERNAL ROTATION IN STANDING

DATA ANALYSIS

- Statistical analysis was done using SPSS 17.0
- Descriptive analysis was obtained by mean & standard deviation.

STATISTICAL DATA ANALYSIS TECHNIQUE

In Group I and Group II all data was expressed as mean ± SD and was statistically analyzed using paired‘t’ test and independent ‘t’ test to determine the statistical difference among the parameters at 0.5% level of significance by employing the statistical tools as given below

Mean $\bar{x} = \frac{\sum x}{n}$; Standard deviation SD = $\sqrt{\frac{\sum(x-x)^2}{n-1}}$

Paired t-test $t_{cal} = \frac{\bar{d}}{s_d/\sqrt{n}}$

Where, $\bar{d}$ = mean difference; S_d = Standard deviation of difference

Independent t – test $t_{cal} = \left|\frac{x^1 - x^2}{SE}\right|$

SE= $s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$

Where, s = SE = $\sqrt{\frac{(n_1-1){s_1}^2 + (n_2-1){s_2}^2}{n_1+n_2-2}}$

n1, n2 = Size of the samples of two groups.

TABLE 1.1: COMPARISON OF PRE TEST AND POST TEST VALUES OF AKPS AND FIQ IN GROUP A

VARIABLES	PRE-TEST			POST-TEST		
	Mean	SD	SEM	Mean	SD	SEM
AKPS	69.73	6.273	1.62	75.4	6.021	1.555
FIQ	6.93	0.884	0.228	10.93	1.1	0.284

Table 1 shows descriptive measures of Pre-test and Post-test values of AKPS and FIQ in group A.

The mean value of AKPS in Post-test is 75.4 with standard deviation (SD) of 6.021 and standard error mean(SEM) of 1.555 which is higher than the mean value of the Pre-test 69.73 with standard deviation (SD) 6.273and standard error mean(SEM) is 1.62.

The mean value of FIQ in Post-test is 10.93 with standard deviation (SD) of 1.100 and standard error mean(SEM) of 0.284 which is higher than the mean value of the Pre-test 6.93 with standard deviation (SD) 0.884 and standard error mean(SEM) is 0.228.

GRAPH 1: COMPARISON OF PRE TEST AND POST-TEST VALUES OF AKPS IN GROUP A AND GROUP B

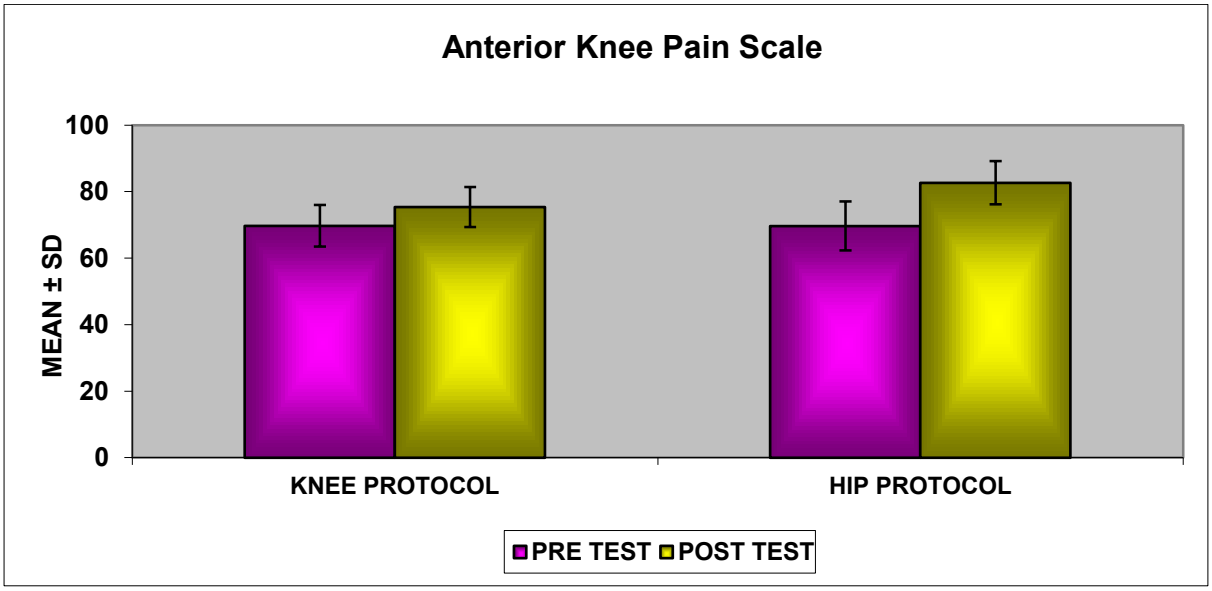

TABLE1. 2: COMPARISON OF PRE-TEST AND POST TEST VALUES OF AKPS AND FIQ IN GROUP B

VARIABLES	PRE-TEST			POST-TEST		
	Mean	SD	SEM	Mean	SD	SEM
AKPS	69.67	7.365	1.902	82.67	6.4888	1.675
FIQ	6.80	1.146	0.296	12.13	1.187	0.307

Table 2 shows descriptive measures of Pre-test and Post-test values of AKPS and FIQ in group B.

The mean value of AKPS in Post-test is 82.67 with standard deviation (SD) of 6.4888 and standard error mean(SEM) of 1.675 which is higher than the mean value of the Pre-test 69.67 with standard deviation (SD) 7.365and standard error mean(SEM) is 1.902.

The mean value of FIQ in Post-test is 12.13 with standard deviation (SD) of 1.187 and standard error mean(SEM) of 0.307 which is higher than the mean value of the Pre-test 6.80 with standard deviation (SD) 1.146 and standard error mean(SEM) is 0.296.

GRAPH 2 COMPARISON OF PRE TEST AND POST-TEST VALUES OF FIQ IN GROUP A AND GROUP B

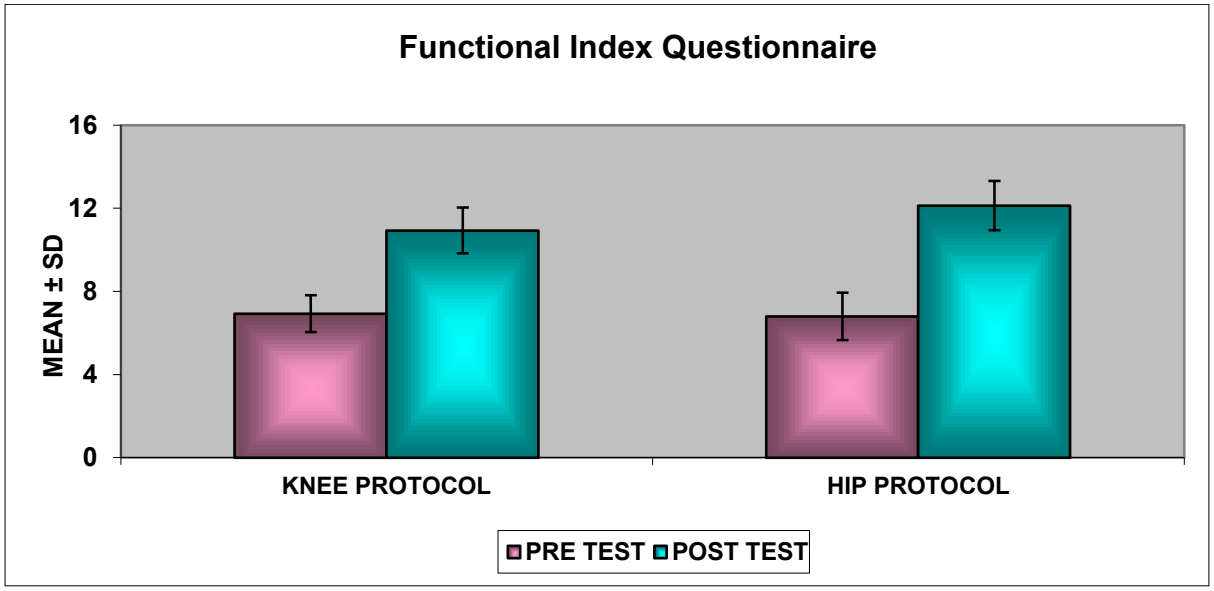

TABLE1.3: PAIRED T-TEST ANALYSIS OF GROUP A

VARIABLES	PAIRED DIFFERENCE						
	Mean	SD	SEM	95% confidence interval of difference		df	t
				Lower	Upper		
AKPS	-5.667	0.9	0.232	-6.165	-5.168	14	-24.393
FIQ	-4	1.134	0.293	-4.628	-3.72	14	-13.663

Table 3 shows the statistical outcome of paired "T" test analysis of AKPS and FIQ in group A.

In Group A the mean of AKPS is increased with paired difference of -5.667 with Standard Deviation (SD) of 0.9 and Standard Error Mean (SEM)

The change in 95% of confident interval is -6.165 to -5.168.

In group A the mean of FIQ is increased with paired difference of -4.00 with standard deviation (SD) of 1.134 and standard error mean (SEM) of 0.293

The change in 95% of confident interval is -4.628 to -3.72

TABLE1.4: PAIRED T TEST ANALYSIS OF GROUP B

VARIABLES	PAIRED DIFFERENCE						
	Mean	SD	SEM	95% confidence interval of difference		df	t
				Lower	Upper		
AKPS	-13.00	3.317	0.856	-14.837	-11.163	14	-15.181
FIQ	-5.33	1.589	0.410	-6.213	-4.454	14	-13.002S

Table 4 shows the statistical outcome of paired "T" test analysis of AKPS and FIQ in group B.

In group B the mean of AKPS is increased with paired difference of -13.00 with standard deviation(SD) of 3.317 and standard error mean(SEM) of 0.856

The change in 95% of confident interval is -14.837 to -11.163.

In group B the mean of FIQ is increased with paired difference of -5.33 with standard deviation(SD) of 1.589 and standard error mean(SEM) of 0.410

The change in 95% of confident interval is -6.213 to -4.454

TABLE1.5: COMPARISONS OF POST TEST SCORES OF AKPS OF GROUP A AND GROUP B

GROUP	Mean	SD	SEM	Mean diff	95% confidence interval	T value	P value
Group A	75.4	6.021	1.555	-7.267	-11.948 to -2.584	-3.179	0.000
Group B	82.67	6.488	1.675	-7.267		-3.179	

Table 5.The statistical outcome measures of post test score of AKPS for group A and group B

The AKPS score of group A mean value of 75.4 and group B mean value 82.67 with mean difference of -7.267

The 95% of confident interval is -11.948 to -2.584 with 'T" value of -3.179 which is statistically significant with ($p<0.005$)0.000.

TABLE1.6: COMPARISON OF POST TEST SCORES OF FIQ IN GROUP A AND GROUP B

GROUP	Mean	SD	SEM	Mean diff	95% confidence interval	T value	P value
Group A	10.93	1.100	0.284	-1.200	-2.056 to 0.344	-2.872	0.000
Group B	12.13	1.187	0.307	-1.200		-2.872	

Table 6.The statistical outcome measures of post test score of FIQ for group A and group B

The FIQ score of group A mean value of 10.93 and group B mean value 12.13 with mean difference of -1.200

The 95% of confident interval is -2.056 to 0.344 with ‘T” value of -3.179 which is statistically significant with ($p<0.005$)0.000.

RESULT AND DISCUSSION

RESULTS:

- The post test score of AKPS and FIQ shows improvement in all two groups
- The post scores of HIP PROTOCOL (Group B) show better improvement in terms of AKPS and FIQ.
- The post test score of KNEE PROTOCOL (Group A) also shows good improvement in terms of AKPS and FIQ But as compared to group B it was less.
- Statistical supports also state that the HIP PROTOCOL would be more beneficial as compared to KNEE PROTOCOL(Group A)
- Group B shows better improvement as compared to Group A

DISCUSSION

Patellofemoral pain syndrome is one of the conditions which can be treated by a wide variety of physiotherapy methods. It is still difficult to formulate all proof guidelines for the management of Patellofemoral pain syndrome. Various methods of treatment exist with own claims of success without any attempts of comparing the maximal effective methods.

The objective of this study was to compare the effectiveness of hip abductors and lateral rotators strengthening with Transverse abdominis activation and Quadriceps strengthening in patients with Patellofemoral pain syndrome.

Clinicians believe that PFPS results from abnormal patella tracking that leads to excessive compressive stress to the patellar facets. Factors that may contribute to abnormal patella tracking include quadriceps weakness, quadriceps muscle imbalances, excessive knee soft tissue tightness, an increased quadriceps angle (Q-angle), hip weakness, and altered foot kinematics.

Based on this clinical theory, the aim for interventions used for the treatment of PFPS in this study is to improve patella tracking and reduce abnormal stress to patellofemoral joint structures. This study result coincides with the result of Chiu JK, et al who conducted a study on the effectiveness of quadriceps strengthening in relieving pain and improving function in patients with patellofemoral pain.[28] Weight-training exercise could have increased knee muscle strength and the patellofemoral joint contact area, which could have reduced mechanical stress in the joint thereby improving pain and function in subjects with PFPS. Performing isolated quadriceps exercises allowed the patients to strengthen knee musculature there by reducing pain. Bolgla et al reported reduced pain with hip exercises for PFPS but these interventions combined knee exercises and/or manual therapy, potentially confounding the results. They reported that quadriceps exercises (open or closed kinetic chain) alone significantly reduced pain levels in most instances[8]

Several other researches which focus on quadriceps strengthening shows significant difference in the outcome measures which supports this study includes Defne Kaya, et al conducted study on improving quadriceps strength in patients with patellofemoral pain and they stated that patients with patellofemoral pain syndrome may tolerate a closed kinetic chain exercises program better

than open kinetic chain. Weight-bearing and non-weight-bearing quadriceps exercises can significantly improve subjective and clinical outcomes in patients with patellofemoral pain syndrome.

The above researches suggest that strengthening of quadriceps alone can improve pain and functional performance in patients with PFPS as in this study where group A patients experience significant difference at the end of 6 weeks of rehabilitation.

Recently, patellofemoral pain syndrome was proposed to be related to reduced hip strength and core endurance. Poor hip control may lead to abnormal patellar tracking, increasing patellofemoral joint stress and causing wear on the articular cartilage, especially poor eccentric hip abductors and lateral rotators muscles control can result in femoral adduction and medial rotation during weight-bearing activities, leading to a predisposition to lateral patellar tracking as the femur medially rotates underneath the patella. Fukuda et al conducted an RCT on 54 females with PFPS to determine whether the addition of hip-muscle strengthening to a more traditional program of knee-muscle stretching and strengthening resulted in better outcomes than the knee program alone. They reported that the addition of the hip-muscle–strengthening exercises resulted in better improvements in pain and function than did a knee-focused rehabilitation program.[20] However, that study involved sedentary females, and the rehabilitation protocol lasted only 4 weeks. Considering the above this study includes a 6 week rehabilitation protocol focusing on hip abductors and lateral rotators strengthening resulting greater improvement in the outcome measures in relieving pain. This study also coincides with the study done by Ismail et al who investigated the effect of adding hip-muscle strengthening to a squatting, step-up, and knee-extension protocol for 32patients with PFP. At the end of the 6-week protocol, the group that performed the additional hip strengthening reported greater improvements in pain control during Functional activities than did the control group.[21]

This theory involves a combination of hip strengthening along with core stabilization for the experimental group as stated by Zazulak et al demonstrated that decreased core proprioception and neuromuscular control was a predictor of knee injury risk in female athletes.[27] However, the term “core” is often used interchangeably with hip strength. Several authors have examined the relationship of muscle weakness in the hip rather than the true abdominal musculature with lower extremity injury risk Prior researchers have identified several risk factors for the increased

incidence of PFPS injuries in female athletes including the lack of core strength, proximal hip muscle weakness, and lower extremity proprioception/balance deficits and the relationship between core strength and the lower extremity has been identified as a potential cause of overall lower extremity functional instability in females.. Overall prior researchers note that hip musculature provides a key element of stability to the knee complex, with the ability to reduce patellofemoral injuries. Mascal et al. reported on two patients with patellofemoral pain who were treated with exercises focused on the recruitment and endurance training of the hip, pelvis and trunk musculature supports this study.[19]

Thus, although the findings of previous studies suggest that including hip- and core muscle strengthening is beneficial to PFP outcomes, no authors have directly compared a hip-corefocused rehabilitation program with a knee-focused rehabilitation program for PFP. No study has compared a rehabilitation protocol focused on strengthening of the hip abductors, lateral rotators musculature with transverse abdominis activation and strengthening of quadriceps treatment approach, to evaluate if there is some additional benefit .thus the aim of this study is to compare both the effects in related to previous studies.

The hip abductors and lateral rotators muscles act eccentrically to prevent femur adduction and medial rotation during weight-bearing functional activity. Strengthening of these muscles in weight bearing prevent tipping of body to the unsupported side there by preventing the legs going for genu valgum (knock knees) which is said to be an important cause for PFPS. The transverses abdominis activation along with hip strengthening acts as a trunk stabilizer supporting low back and pelvis thereby narrowing the waist and flattens lower abdomen. Transverse abdominis contracts bilaterally to form a musculofascial band that appears to tighten like a corset and improves the stability of lumbopelvic region. Transverse abdominis is the first muscle to be activated as it provides proximal stability for distal mobility during lower extremity movements

Results indicate that there is significant improvement in pain and functional performance in patients with Patellofemoral pain syndrome at the end of 6weeks in all the two groups after Hip abductors and lateral rotators strengthening with Transverse abdominis activation and Quadriceps strengthening. But according to the scores obtained in Anterior Knee Pain Scale and Functional Index Questionnaire hip strengthening was more effective than quadriceps strengthening

The two treatment groups obtained successful outcomes as measured by significant improvement in AKPS score and FIQ after 12 sessions of intervention. Group B shows significant difference in intensity of pain and functional performance as per AKPS and FIQ than Group A.

LIMITATION OF THE STUDY

1. The study consists of a small quantity of patients.

2. No long term follow up was done.

3. No blinding was done.

SCOPE FOR FURTHER STUDY

1. Further study can be done with larger sample size.

2. Study can be done with long term follow up.

3. The same study can be done by activating both transverse abdominis and multifidus on patients with patellofemoral pain syndrome.

CONCLUSION

From the result of the study it was concluded that after 6weeks of treatment Hip abductors and lateral rotators strengthening with core stabilization (Hip protocol) and Quadriceps strengthening (knee protocol) were effective in the treatment of Patellofemoral pain syndrome ,but hip core strengthening was found to have greater effect than knee strengthening in relieving pain and improving functional performance in patients with Patellofemoral pain syndrome.

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PROFORMA

Name	:	
Age	:	
Gender	:	Male/Female
Occupation	:	
Marital Status	:	
Chief Complaints	:	
Past Medical History	:	
Present History	:	
Personal History	:	
Socio-economic History	:	

VITAL SIGNS

I.	Heart Rate	:
II.	Pulse	:
III.	Blood Pressure	:
IV.	Respiratory Rate	:
V.	Temperature	:

PAIN ASSESSMENT

Site :

Side :

Duration :

Type :

Nature :

Aggravating Factors :

Severity :

Visual Analogue Scale (VAS) :

ON OBSERVATION

General Observation :

Local Observation :

PALPATION

Swelling :

Tenderness :

Warmth :

Crepitus :

EXAMINATION

Muscle Power :

Muscles	Right	Left

Special Tests :

- Patellar Grind Test

INVESTIGATION

1. X-Ray :
2. MRI

:

VARIABLES	PRE TEST	POST TEST
AKPS		
FIQ		

PHYSIOTHERAPY MANAGEMENT

PLAN OF TRETMENT

- Short Term Goal
- Long Term Goal

Signature of the Investigator

Signature of the Subject

INFORMED CONSENT FORM

I ……..……. Agree to participate in the research study conducted by Ms.DIVYA.M, II year, MPT (Ortho), Madha College of Physiotherapy entitled "EFFECTIVENESS OF HIP STRENGTHENING WITH CORE STABILIZATION VERSUS KNEE STRENGTHENING IN IMPROVING PAIN AND FUNCTION IN PATIENTS WITH PATELLOFEMORAL PAIN SYNDROME"

I acknowledge that the research study has been explained to me and I understand the agreeing to participate in the research means I am willing to,

1. Provide information about my health status to the researcher(s)
2. Allow the researcher(s) to have access to my professional records pertaining to the purpose of the study.
3. Participate in training program for duration of 6 weeks
4. Make myself available for follow up.
5. Understand and follow the home advice(s) that will be provided.

I have been informed about the purpose; procedure(s), measurement(s) and risk(s) involved in the research and my queries towards the research have been clarified.

I provide consent to the researcher to use the information, video recording(s), for research and educational purpose only.

I understand that my participation is voluntary and can withdraw at any stage of the research project.

Name of the Participant Date

Signature

APPENDICES

APPENDIX 1

KNEE PROTOCOL

Week	Exercise	Sets	Repetitions
1	Isometric Quadriceps Setting	3	10
	Knee extension – Standing	3	10
	Double-Legged, One-Quarter Squats	3	10
2	Isometric Quadriceps Setting	3	15
	Double-Legged, One-Half-Squats	3	15
	Terminal Knee Extension w/resistance band	3	15
	Double legged One-Quarter Squats	3	30 secs
3	Double legged One-Half Squats	3	10
	Single legged One-Quarter Squats	3	10
	Double legged One-Quarter Wall Squats	3	10
	Terminal Knee Extension w/resistance band	3	10
4	Single legged One-Half Squats	3	10
	Forward Lunges	3	10
	Lateral step down	3	10
	Forward Step down	3	10
	Double legged One-Half Wall Squats	3	30 secs
5-6	Double legged Wall Squats max. 90 degree Knee flexion	3	45 - 60 secs
	Lateral Step down	3	15
	Forward Step down	3	15
	Single legged One-Half Lunges max. 90 degrees flexion	3	15
	Single legged One-Half full squat max. 90 degrees flexion	3	15

APPENDIX 2

HIP PROTOCOL

Week	Exercise	Sets	Repetitions
1	Hip abduction-Standing	3	10 reps
	Hip external rotator-Standing	3	
	Hip external rotator - seated	3	
2	Hip abduction-Standing	3	10reps
	Hip external rotator – Standing	3	
3	Hip abduction-Standing w/ Stronger band	3	10 reps
	Hip external rotator-Standing w/ Stronger band	3	
	Balancing 2 feet	3	30 - 45 Secs
4 – 6	Hip extension at 45 degrees-Standing	3	10 - 15
	Hip external rotator-standing	3	10 - 15
	Balancing 1 foot	3	45 - 60 Secs

MASTER CHART

KNEE PROTOCOL (GROUP A)					HIP PROTOCOL (GROUP B)				
S.NO	Anterior Knee Pain Scale		Functional Index Questionnaire		S.NO	Anterior Knee Pain Scale		Functional Index Questionnaire	
	Pre-test	Post-test	Pre-test	Post-test		Pre-test	Post-test	Pre-test	Post-test
1	75	80	9	13	1	62	70	6	13
2	74	82	7	10	2	75	83	7	14
3	70	78	6	12	3	65	74	6	12
4	65	70	7	12	4	56	70	5	13
5	68	74	7	10	5	75	84	7	12
6	74	80	8	10	6	78	86	6	10
7	60	68	6	12	7	65	74	8	13
8	75	80	7	12	8	70	80	7	12
9	64	75	6	10	9	75	84	6	13
10	78	84	7	10	10	78	86	5	11
11	56	62	8	12	11	60	68	8	13
12	74	80	7	10	12	72	82	7	10
13	68	75	6	10	13	74	80	7	12
14	70	75	6	10	14	62	68	9	11
15	75	84	7	11	15	78	84	8	13

Functional Index Questionnaire (FIQ)

Please answer the following questions by putting a tick in the appropriate box or column.

During the last 24 hours have you had any pain from your knee?

Slight or Intermittent		*Constant*	

During the last 24 hours have you walked with a limp?

Slight or Intermittent		*Constant*	

	Unable to do	*Could with a problem*	*No Problem*
Walk as far as 1 mile on flat ground			
Climb up 2 flights of stairs			
Walk down 2 flights of stairs			
Drive for ½ hour			
Squat			
Kneel			
Sit for ½ an hour with knees bent at 90 degrees			
Run 100 yards			

APPENDIX

ANTERIOR KNEE PAIN (Sheet code: _____)

Name: _____ Date: _____

Age: _____

Knee: L/R

Duration of symptoms: _____ years _____ months

For each question, circle the latest choice (letter), which corresponds to your knee symptoms.

1. Limp
(a) None (5)
(b) Slight or periodical (3)
(c) Constant (0)

2. Support
(a) Full support without pain (5)
(b) Painful (3)
(c) Weight bearing impossible (0)

3. Walking
(a) Unlimited (5)
(b) More than 2 km (3)
(c) 1-2 km (2)
(d) Unable (0)

4. Stairs
(a) No difficulty (10)
(b) Slight pain when descending (8)
(c) Pain both when descending and ascending (5)
(d) Unable (0)

5. Squatting
(a) No difficulty (5)
(b) Repeated squatting painful (4)
(c) Painful each time (3)
(d) Possible with partial weight bearing (2)
(e) Unable (0)

6. Running
(a) No difficulty (10)
(b) Pain after more than 2 km (8)
(c) Slight pain from start (6)
(d) Severe pain (3)
(e) Unable (0)

7. Jumping
(a) No difficulty (10)
(b) Slight difficulty (7)
(c) Constant pain (2)
(d) Unable (0)

8. Prolonged sitting with the knees flexed
(a) No difficulty (10)
(b) Pain after exercise (8)
(c) Constant pain (6)
(d) Pain forces to extend knees temporarily (4)
(e) Unable (0)

9. Pain
(a) None (10)
(b) Slight and occasional (8)
(c) Interferes with sleep (6)
(d) Occasionally severe (3)
(e) Constant and severe (0)

10. Swelling
(a) None (10)
(b) After severe exertion (8)
(c) After daily activities (6)
(d) Every evening (4)
(e) Constant (0)

11. Abnormal painful kneecap (patellar) movements (subluxations)
(a) None (10)
(b) Occasionally in sports activities (6)
(c) Occasionally in daily activities (4)
(d) At least one documented dislocation (2)
(e) More than two dislocations (0)

12. Atrophy of thigh
(a) None (5)
(b) Slight (3)
(c) Severe (0)

13. Flexion deficiency
(a) None (5)
(b) Slight (3)
(c) Severe (0)

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