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Effect of Patellar Realignment Training in Patellofemoral Pain Syndrome

Ketaki Patil[1], Poonam Patil[2]

[1]Intern, Department of Physiotherapy, Krishna Institute of Medical Sciences "Deemed to be" University, Karad, Maharashtra, 415110, India, [2]Assistant Professor, Department of Cardiopulmonary Sciences, Faculty of Physiotherapy, KIMS "Deemed To Be University", Karad, Maharashtra, 415110, India.

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Abstract

Objective: PFPS is a common musculoskeletal dysfunction presenting with anterior knee pain. The purpose of this study was to investigate whether implementation of realignment training can achieve early pain and functional ability improvements in patients with PFPS

Method: 37 females, 20-45 year of age with PFPS, were randomly assigned into two treatment Group 1 received realignment training in addition to conventional treatment protocol whereas Group 2 as a control group received routine treatment for 4 weeks. The outcome measures was Visual analogue scale (VAS), range of motion, manual muscle testing (MMT), Q angle, postural assessment.

Results: The results obtained show that both the groups showed significant improvement in the outcome variables and therefore aids with early correction of dysfunction. Within group analysis showed statistically more significant improvement in all outcome measures for Group 1.

Conclusion: This Is a cross sectional study comparing effect of realignment training and the conventional treatment protocol in PFPS on 37 total subjects. We found that realignment training showed significant improvement in the outcome variable concluding that it improves functional ability and reduce pain. It can be further concluded that Conventional treatment can be more efficacious if combined with realignment training.

Keywords: [Patellar realignment training, patellofemoral pain syndrome, anterior knee pain, k-taping, mobilization with movement, Alta, Q-angle]

Introduction

Pain syndrome (PFPS) is one in every of the most common knee complaints, especially among females[1]. The incidence within the general population is 25% in adolescents and adults [1,2]. Patellofemoral pain syndrome (PFPS) is difficult to define, as patients experience a range of symptoms from the patellofemoral joint with different levels of pain and physical impairment. The term 'anterior knee pain' is recommended to encompass all pain-related problems of the anterior part of the knee. The term 'patellofemoral' seems appropriate, as no distinction are often made as to which specific structure of the

Corresponding Author: Poonam Patil, Assistant Professor, Department of Cardiopulmonary Sciences, Faculty of Physiotherapy, KIMS "Deemed To Be University", Karad, Maharashtra, 415110, India.

E-mail: dr.ppatil8383@gmail.com

Mobile: 8806111153

patella or the femur is affected. 'Pain' is the symptom that each one patients experience, but patients produce other symptoms likewise, and thus it's appropriate to use the word 'syndrome', defined as a bunch of signs and symptoms that occur together and characterise a particular abnormality[3]. PFP may be a chronic, painful condition predominantly of insidious onset, which regularly persists despite provision of evidence-based treatments[2]. It is usually experienced during running, squatting, stair climbing, prolonged sitting, and kneeling[4].

Stability of the patellofemoral joint (PFJ) is basically maintained by soft tissues, specifically, the dynamic balance of the medial and lateral quadriceps muscle[3]. By excluding anterior knee pain because of intra-articular pathology, peripatellar tendinitis or bursitis, plica syndromes, Sinding Larsen's disease, Osgood Schlatter's disease, neuromas and other rarely occurring pathologies it's suggested that remaining patients with a clinical presentation of anterior knee pain can be diagnosed with PFPS[3]. Patellofemoral pain is caused by many pathophysiological processes. A tightness of the soft tissue round the knee joint and a quadriceps muscle imbalance have frequently been described because the contributing factors in patellofemoral pain[6]. The abnormal relationship in the vastus medialis obliques (VMO) and vastus latralis (VL) activation pattern may modify the dynamics of the patellar-femoral joint. This imbalance may cause lateral tracking of the patella by the action of VL during knee extension[1]. Increased Q-angle, genu valgum, foot pronation, and/or joint overuse have been proposed as a number of the factors that predispose for PFPS[7]. These factors may induce a delayed contraction or weakness of vastus medialis oblique (VMO) with relation to vastus lateralis (VL), lateral displacement of the patella, and inadequate control of knee flexion during walking downstairs[8]. Several studies have reported various factors that cause PFPS, like quadriceps, abnormal hip biomechanics, inflexibility and malalignment of the lower limbs, and altered neuromuscular control. Among these, quadriceps tightness can cause patellar alta and patellar tilt, which end in quadriceps weakness and muscle imbalance caused by pain thanks to increased compression force of the patellofemoral joint and abnormal movements of the patella during knee motion thus, the progression of PFPS is also accelerated[9].

severity may remain unchanged or progress in 50% of affected individuals, often restricting an individual's participation in physical activity 40 and potentially reducing quality of life (QoL)[2]. However, its etiology remained unclear and controversial. Management may be challenging, a handy and non-operative treatment program usually allows patients to return to recreational and competitive activities. Physiatrics is that the first line of treatment for PFPS. The clinical efficiency of several different treatment regimens are studied; however, a recent systematic review reveals an absence of high-quality clinical trials during this area[10].

The purpose of this study was to determine the effect of realignment training (K-taping and Mobilization with Movement) in the treatment of patients with PFPS. We hypothesized that PFPS patients who received realignment training with the aid of K-taping and Mobilization with Movement , along with the exercise therapy over 3 weeks , would have less pain , higher soft tissue flexibility and improved functional performance compared to the patients who received exercise therapy alone.

Method

Thirty-seven female subjects aged between 20 and 45 years who were referred to Physiotherapy with a Diagnosis of unilateral PFPS participated in this study. Subjects were included if they had anterior knee pain brought on by two (or more) of the following Without traumatic onset: prolonged sitting, stair climbing, descending; running; kneeling; hopping/jumping; Pain on palpation of patellar facets; a step down. Exclusion criteria for this study were:

1. Postoperative patients
2. Osteoarthritis
3. Patellar fracture/injury

Subjects taking analgesic or anti-inflammatory medication were instructed to cease it in order to avoid it's possible effect on intervention. All patients signed a consent form after been informed about the aim of the study.

Subjects were randomised in two groups: Group 1 (experimental group) and Group 2 (controlled group). Both groups received the same muscle strengthening and stretching exercises for 4 weeks. The experimental Group 1 additionally received MWM prior to the exercise program and K-taping at end of the session.

Pain-free MWMs consisted of two techniques in a particular order. The first technique was a medial glide of the patella relative to femur and the second an internal rotation of the tibia relative to the femoral condyles, both applied by the therapist. Simultaneously patient was asked to perform active flexion -extension of the knee in a sitting position (knee open kinetic chain movement) and semi-squatting in the standing position (knee closed kinetic chain movement) for both mobilization techniques. Mulligan techniques were performed in Group 1, each MWM was implemented in 3 sets of 10 repetition, with interval of 30 seconds between each set, 3 sessions a week for 4 weeks.

The exercise program consisted of stretching of hamstring and quadriceps muscles, iliotibial band/ tensor fascia lata (ITB/TFL) complex. Gradually progressive isometric and isotonic exercises for quadriceps, hip adductors these strengthening exercises were performed in 3 sets of 10 repetition.

For the application of K-taping The knee should be completely relaxed and a foam roller or rolled up towel under the knee. Then one strip of tape is applied under the patella with close to maximal tension. Another strip of tape is split in the middle until around 3-4 cm from the top which leaves the anchor intact. Then anchor is to be applied proximally to the patella this leaves then room to wrap the two tails around the patella. The medial tape is going down around the patella and anchor it laterally on the tibia. The lateral tape is going to go down around the patella laterally with aim to translate the patella, medially to offload the patellofemoral joint.

Visual analogue scale was used to measure the intensity of knee at rest and on activity. Whereas examination of ROM is taken by goniometer. For muscle performance MMT was done. Similarly for examination of Q angle patient is ask to lay down in supine the then imaginary line were drawn from ASIS to centre of patella and from centre of Patella to tibial tuberosity and this angle of intersection is measured by goniometer.

Statistical Analysis: The data were Expressed as mean values and their standard Deviation (SD). The variables were analysed By two-way analysis of variance (ANOVA). In this study, descriptive statistics such as bar diagrams, and percentages were used to statistically assess the acquired data. The statistical significance level was set at t-test at $p < 0.0001$.

Results

1. Pain assessment

Table 1: Pain Assessment

Pre	Mean	SD	p-value
On Rest	0.9444	0.9376	0.0114
On Activity	4.8889	1.491	0.0170
Post			
ON Rest	0.2777	0.4609	<0.0001
On Activity	2.6667	0.8402	0.0012

Interpretation: We may conclude from Graph 1 and Table 1 that the severity of pain on activity in Group 1 is much lower than in Group 2.Group 1 had mean reduction of 2.667+-0.8402. whereas Group 2 had mean pain reduction of 3.833+-1.043. The p-value is <0.0001 regarded as highly significant.

2. Range of motion

Table 2: Range of motion

Pre	Mean	SD	p-value
Flexion	134.444	3.258	>0.10
Extension	132.67	3.678	0.0487
Post			
Flexion	136.3889	1.720	0.0003
Extension	135.50	2.333	0.0045

Interpretation: From the above Graph 2 and Table 2 we can interpret that range of motion at knee joint is significantly increased in Group 1 if compared with Group 2. also the p-value is very significant.

3. MMT

Table 3: Manual muscle test

Pre	MEAN	SD	p-value
Quadriceps	3.444	0.5113	<0.0001
Hamstring	3.778	0.6468	0.0001
Post			
Quadriceps	4.222	0.4278	<0.0001
Hamstring	4.389	0.5016	<0.0001

Interpretation: From graph 3 and table 3 we can interpret that in Group 1 muscle power is significantly improved as compared to Group 2. Group 1showed increased muscle power with quadriceps mean 4.222+-0.4278 and hamstring mean 4.389+-0.5016 while in Group 2 mean quadriceps 3.722+-0.4609 and hamstring mean 4.222+-0.5483.

4. Q Angle

Table 4: Q angle.

Q angle	Mean	SD	P value
Pre	22.222	1.478	0.0028
Post	21.500	1.043	0.0002

Interpretation: From Graph 4 and Table 4 we can interpret that in Group 1 Q-angle is significantly reduced as compared to Group 2. Group 1 showed reduction in Q-angle with mean 21.500+-1.043 while in Group 2 mean 22.000+0.8402.the p-value is 0.287 is regarded as significant.

5. Postural assessment

Table 5: Postural Assessment

Alta	Group 1	Group 2
Alta present	12	12
Alta present	4	11
Alta recovered	8	1

Interpretation: from Graph 5 we can interpret that patella alta is recovered in Group 1 with 66 percentage.

Discussion

In general, the major goal of this study was to determine the effect of realignment training (K-taping and mobilization with movement) by improving functional mobility and relief of pain. Both groups were effective in correction of patellofemoral pain syndrome and realignment training proved more efficacious. In the present study, it was found that majority of subjects experienced chronic insidious anterior knee pain. Also, the present study signifies that ROM, pain, muscle power, Q-angle and misaligned patella showed combined improvement which interprets the fact that malalignment of patella might because of weak vastus medialis oblique muscle. Over the course of treatment, there was a significant reduction in pain intensity in both groups.

Treatment protocol was in various phases and used a symptom specific approach, which is lacking in group 2, which might be a responsible factor for a more marked improvement in group 1. Additionally, there is no published study that specifically focuses on realignment training in patient with patellofemoral pain syndrome. In last few years, several studies have demonstrated different results regarding the effect of physiotherapy treatments in management of patellofemoral pain syndrome. Early physiotherapy interventions are a valuable treatment option. Treatments that are easily accessible, low cost-effective, and reversible should be given priority. Traditional physiotherapy programs focus on strengthening of quadriceps especially vastus medialis to improve patellar tracking[11'12]. The purpose of exercise treatment is to help the patella stay in the right position during movement as well as to decrease related pain associated with movement when patella is in the wrong track and position by proprioceptive neuromuscular assistance[13]. In general, PFPS treatments concentrate on the patellofemoral joint and include strengthening of the vastus medialis oblique (VMO), taping, soft tissue mobilization, and patellar mobilization[12]. Exercising programs require between 3-6 weeks or more to achieve the goal[15].

Various authors have documented the strong hypoalgesic reaction to mobilization[15].Two studies have shown decreased patellar mobility within PFPS patients. Witvrouw (2000) reported that medial and lateral patellar mobilization were beneficial in PFPS but the findings were not significant15. On the other hand, regarding to my treatment result, patellar mobilization was effective at reducing pain and restoring the patellofemoral joint functional within 1 to 3 sessions in a week. The theory underlying

Mulligan's MWM is that 'when a joint is injured or strained, minor positional faults occur, which result in limitation of movement and/or pain'. Mulligan also stated that pain may subside and range of motion may be increased, if such a joint is forced to be actively moved from a 'correct position'[8]. We assume motor control theory as the most appropriate mechanism for improvements in outcome measures of PFPS patients, treated with functional kinesiotherapy (MWM) and functional therapeutic exercise. However, since exercises, in the present study, were used in conjunction with realignment training, it remains unknown whether pain and functionality could be improved in a short amount of time, if the intervention program contained only exercises. Our decision to perform MWM prior to different types of exercise and K-taping at end of session was based on the fact that exercises alone, as demonstrated by previous studies, provided pain relief in PFPS patients in no more than 6 weeks after initiation of treatment[8].

In a study by Osorio et al. (2013) 20 patients with active PFPS were found to improve perceived pain. Osorio noted a reduction in pain following the application of both Spider and McConnell techniques versus the baseline; however, there was a greater decrease in pain after applying the Spider technique. Presumably the reason for this difference is that the latter type of bandage (Spider) covers a larger area on the knee than the McConnel technique. Moreover, Osorio et al. (2013) noticed an increase in isokinetic quadriceps strength after applying both Spider & McConnel techniques compared to the baseline, but found no difference between the two. Chen et al. (2008) demonstrated the efficacy of KT, which improved patellar pain and stability in 15 women diagnosed with PFPS compared with a control group of 10 healthy women; it was thought that the quadriceps muscle was activated earlier in the KT group than in the no tape group, in addition there were no differences found between the placebo and the no tape group. Finally, Chen et al. (2008) also found there was decrease in pain after application of KT. KT in addition has advantage not only on the knee pain caused by PFPS. Osterhues (2004), in a study of a case of patellar dislocation, observed that the use of KT increased quadriceps muscle activity and joint stability during functional activities.

There are some attainable reasons why K-taping improved the flexibility soft tissues sooner than the control group in the present study. Within the taped area the K-taping increased blood circulation, which could affect the muscle and myofascia functions after kinesio taping. The application of kinesio tape might stretch the skin by applying pressure to the skin and this external load might stimulate cutaneous mechanoreceptors, causing physiological changes and increased flexibility of soft tissues in the taped area.

Numerous studies of Kinesio taping and MWM are done on knee condition such as anterior knee pain but there is no such study focusing on realignment of the patella for PFPS by using K-taping and MWM as component of realignment training protocol. The present study showed realignment training with exercise exceed the exercise therapy in patients with PFPS in four-week therapy. The main finding of the present study revealed immediate and significant pain and functional improvements in patients with PFPS following one week of realignment training. Further research is needed to follow up the long-term effect of realignment training protocol, either individually or in conjunction with therapeutic exercise, in PFPS patients and to investigate possible mechanism of action.

Conclusion

This Is a cross sectional study comparing effect of realignment training and the conventional treatment protocol in PFPS on 37 total subjects. We found that realignment training showed significant improvement in the outcome variable concluding that it improves functional ability and reduce pain. It can be further concluded that Conventional treatment can be more efficacious if combined with realignment training.

Limitations

- Since the study group size was small, study results cannot be generalized for the entire population. The limitations faced were because of the shorter duration for study.
- limited to one geographical location.
- More appropriate method is needed to assess and evaluate the patella alta.

Suggestions and recommendations:

- This study can be performed on a larger population.
- This study can be made more precise with more details.
- Further research is needed to investigate the long-term effect of realignment training.
- This study can be further taken up for further research so that we can properly assess the subjects and find out the efficacy of realignment training on PFPS and new method to assess and evaluate the patella alta is needed.
- Above mentioned suggestions and recommendations can be considered for future research

Conflict of Interest: Nil

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Ethical Clearance: Study approved by Instotitional Ethics Committee of Krishna Institute Of Medical Sciences, Karad

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