EFFECT OF PATELLAR REALIGNMENT TRAINING IN PATELLOFEMORAL PAIN SYNDROME

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Abstract

Objective: Anterior knee pain is a typical musculoskeletal dysfunction that is associated with PFPS. This study set out to determine whether realignment training implementation could lead to early pain and functional ability improvements in PFPS patients.

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: According to the results, both groups significantly improved on the outcome variables, which helps with the early detection and treatment of dysfunction. An improvement in all outcome measures for Group 1 was statistically more significant, according to a within-group analysis.

Conclusion: In this cross-sectional study, a total of 37 patients were examined to compare the effects of realignment training and the standard treatment procedure for PFPS. Realignment training significantly improved the outcome variable, which led us to the conclusion that it enhances functional capacity and lessens discomfort. Further conclusion: When paired with realignment training, conventional therapy may be more effective.

Keywords: Patellar realignment training, patellofemoral pain syndrome, k-taping, mobilization with movement, anterior knee pain, 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]. As patients report a variety of symptoms from the patellofemoral joint with varying degrees of discomfort and physical disability, patellofemoral pain syndrome (PFPS) is challenging to characterise. It is advised to refer to all pain-related issues with the anterior region of the knee as "anterior knee discomfort." As no difference is frequently made as to whether specific structure of the patella or the femur is afflicted, the name "patellofemoral" appears suitable. 'Pain' is the symptom that each one patient's 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[5] . 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] . Numerous studies have identified a number of variables, including quadriceps, poor hip biomechanics, rigidity and misalignment of the lower limbs, and alterations in neuromuscular control, that contribute to PFPS. 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] .

Symptom 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]. Its aetiology, however, is still debatable and unknown. Although management might be difficult, a practical and non-invasive treatment plan typically enables patients to resume competitive and leisure activities. The first line of treatment for PFPS is physiatry. 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] .

In order to treat patients with PFPS, this research sought to ascertain the effectiveness of realignment training (K-taping and Mobilization with Movement). We predicted that PFPS patients who underwent realignment training using K-taping and Mobilization with Movement together with exercise treatment over the course of three weeks would have less discomfort, have more soft tissue flexibility, and perform better functionally.

Method:

In this study, 37 female individuals with a diagnosis of unilateral PFPS who were referred to physiotherapy and ranged in age from 20 to 45 years participated. Subjects were included if they experienced two or more of the following types of anterior knee pain: Running, kneeling, hopping/jumping, extended sitting, stair climbing, and descending; without a traumatic beginning. Pain on probing of the patellar aspects. A step down. For this study's exclusion criteria, there were:

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

In order to prevent any potential interference from analgesic or anti-inflammatory medication, subjects were instructed to stop taking it. After being informed of the study's purpose, each patient signed a consent form.

Randomization divided the subjects into two groups: Group 1 (the experimental group) and Group 2. (controlled group). For four weeks, the identical muscle-strengthening and -extending workouts were given to both groups. Additionally, MWM was given to experimental Group 1 before to the exercise programme and K-taping was given at the conclusion of the session.

The two approaches that made up pain-free MWMs were done so in a certain order. The therapist used two different techniques: an internal rotation of the tibia with respect to the femoral condyles and a medial glide of the patella with respect to the femur. Both mobilisation treatments required the patient to undertake active knee flexion-extension in the sitting position (knee open kinetic chain movement) and semi-squatting in the standing position (knee closed kinetic chain movement). In Group 1, Mulligan methods were used in 3 sets of 10 repetitions, with a 30 second break between each set, throughout the course of 3 sessions each week for 4 weeks.

The workout regimen included iliotibial band/tensor fascia lata (ITB/TFL) complex and hamstring and quadriceps muscle stretches. Exercises for strengthening the quadriceps and hip adductors were done in three sets of ten repetitions using isometric and isotonic movements.

A foam roller or cloth folded up should be placed under the knee and it should be totally relaxed before applying K-taping. The patella is then covered with one strip of tape that has almost maximum tension. Up to about 3 to 4 cm from the top, a second strip of tape is split along the centre, leaving the anchor whole. Applying the anchor close to the patella allows space for the two tails to be wrapped around the patella. The medial tape will wrap over the patella and secure it to the tibia laterally. In order to translate the patella and unload the patellofemoral joint, the lateral tape will be applied around the patella laterally.

The intensity of the knee at rest and during exercise was measured using a visual analogue scale. While a goniometer is used to measure the ROM. MMT was done to improve muscular performance. Similar to this, the patient is asked to lie down supine for the Q angle examination. An imaginary line is then drawn from the ASIS to the patella's centre and from the patella's centre to the tibial tuberosity, and the angle at which these lines intersect is measured using a goniometer.

Statistical Analysis:

The information was presented as mean values and standard deviation (SD). Two-way analysis of variance was used to analyse the variables (ANOVA). In this study, the collected data were statistically evaluated using descriptive statistics like bar diagrams and percentages. The t-test's significance level was set at $p<0.0001$ for statistical significance.

Results:

Table no. 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

We may conclude from 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.

Table no. 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

From the above 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.

Table no. 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

From 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.

Table no.4: Q angle.

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

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.

Table no.5: Postural Assessment

ALTA	**Group 1**	**Group 2**
ALTA Present	12	12
ALTA Present	4	11
ALTA Recovered	8	1

From Table 5 we can interpret that patella ALTA is recovered in Group 1 with 66 percentage.

Discussion:

The main objective of this study was to evaluate the effectiveness of realignment training (K-taping and mobilisation with movement) on pain alleviation and functional mobility. Both groups had success treating patellofemoral pain syndrome, albeit realignment training was more successful. The majority of the individuals in the current research reported having nagging, persistent anterior knee discomfort. Additionally, the results of the current study indicate that ROM, discomfort, muscular strength, Q-angle, and misaligned patella all improved together, which suggests that a weak vastus medialis oblique muscle may be the source of patellar malalignment. Both groups' pain levels significantly decreased throughout the duration of therapy.

A more pronounced improvement was seen in group 1 due to the treatment protocol's multiple phases and symptom-specific approach, which was lacking in group 2. Furthermore, there hasn't been any published research on realignment training for patients with patellofemoral pain syndrome. Several studies have produced conflicting findings in recent years about the effectiveness of physiotherapy therapies in the treatment of patellofemoral pain syndrome. Early physical therapy interventions are a beneficial kind of treatment. Priority should be given to treatments that are reversible, affordable, and simple to get. 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[1]5.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. However, in terms of my treatment outcome, patellar mobilisation was successful in lowering discomfort and regaining the patellofemoral joint's functionality in just one to three sessions per week. Mulligan's MWM is based on the idea that "minor positional defects arise when a joint is damaged or strained, which result in restriction of mobility and/or discomfort." 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 that improvements in outcome measures for PFPS patients receiving functional kinesiotherapy (MWM) and functional therapeutic exercise are best explained by the motor control theory. Exercises were used in conjunction with realignment training in the current study, so it is unknown whether pain and functionality could be improved quickly if the intervention programme only included 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] .

20 individuals with active PFPS were shown to have improved perception of pain in a research by Osorio et al. (2013). Osorio saw a decrease in discomfort after using the McConnell and Spider procedures compared to the baseline, although the Spider approach caused the most of the reduction. The second style of bandage (Spider) covers a wider area on the knee than the McConnel approach, which is likely the cause of the disparity. Additionally, Osorio et al. (2013) reported no differences between the Spider & McConnel approaches but saw an increase in isokinetic quadriceps strength following application of both. The effectiveness of KT was demonstrated by Chen et al. (2008), who found that it reduced patellar pain and improved patellar stability in 15 women with PFPS when compared to a control group of 10 healthy women. It was hypothesised that the quadriceps muscle activated earlier in the KT group than in the no tape group, but no differences were found between the placebo and no tape groups. Last but not least, Chen et al. (2008) discovered that

pain decreased following KT treatment. Additionally, KT benefits are not limited to the PFPS-related knee discomfort. In an instance of patellar dislocation, Osterhues (2004) found that using KT enhanced quadriceps muscle activation and joint stability while doing functional tasks.

There are various plausible explanations for why K-taping increased soft tissue flexibility more quickly than the control group in this research. Increased blood flow caused by K-taping might have an impact on how well the muscles and myofascia work following kinesio taping. By exerting pressure on the skin, kinesio tape application may stretch the skin and excite the cutaneous mechanoreceptors, leading to physiological changes and greater flexibility of soft tissues in the taped region.

Kinesio taping and MWM have been the subject of several research on knee conditions such anterior knee pain, but no such study has been done on realigning the patella for PFPS utilising K-taping and MWM as part of a realignment training regimen. In the current study, it was shown that realignment training and exercise outperformed exercise treatment in treating PFPS patients for four weeks. The major conclusion of the current study showed that one week of realignment training resulted in rapid and considerable pain and functional improvements in patients with PFPS. Further study is required to monitor the long-term effects of the realignment training regimen in PFPS patients, either alone or in combination with therapeutic exercise, as well as to look into potential mechanisms 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. Realignment training significantly improved the outcome variable, which led us to the conclusion that it enhances functional capacity and lessens discomfort. Further conclusion: When paired with realignment training, conventional therapy may be more effective.

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

Source of funding: Self

Ethical Clearance: The Krishna Institute of Medical Sciences in Karad's institutional ethics committee has approved the study.

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