Effect of VMO Strengthening Versus Patellar Taping in Patellofemoral Pain Syndrome- A Comparative Study

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Abstract

Background: Patellofemoral pain syndrome (PFPS) which is often used interchangeably with "anterior knee pain" or "runner's knee" is the clinical entity of stiffness or pain or both on prolonged sitting with the knees flexed and pain with activities that load the patellofemoral joint, such as climbing or descending stairs, squatting, running and kneeling. Varieties of conservative treatments are suggested like quadriceps strengthening, stretching, braces and straps, electrotherapy, foot orthosis, patellar taping etc. Hence, comparison between the two techniques vastus medialis obliqus muscle strengthening and patellar taping were undertaken to determine their effectiveness with respect to pain and function.

Materials and Method: After taking informed and written consent, 30 subjects diagnosed with unilateral or bilateral PFPS were randomly selected and allocated into two groups - Group A (VMO muscle strengthening and conventional physiotherapy treatment) and Group B (Patellar taping and conventional physiotherapy treatment). Both groups received five treatment sessions per week for 6 weeks. Pre and post pain and function were measured by visual analogue scale (VAS) and kujala patellofemoral scale (KPS) respectively. Wilcoxon Signed Rank Test and Mann Whitney 'U' Test were used for statistical analysis.

Findings: There was significant improvement in pain and function in patients with Patellofemoral pain syndrome at the end of 6 weeks in terms of VAS and KPS within both groups ($p<0.05$). But there was no significant difference regarding improvement in pain and functional status in patients with Patellofemoral pain syndrome at the end of 6 weeks in terms of VAS and KPS between groups.

Conclusion: The effect of conventional physiotherapy treatment along with VMO muscle strengthening is similar to the conventional physiotherapy treatment along with patellar taping in improving pain and functional level in patients with patellofemoral pain syndrome at the end of 6 weeks.

Key words: *Patellofemoral pain syndrome, Vastus Medialis obliqus strengthening, Patellar taping, Visual analogue scale, Kujala patelofemoral scale.*

Introduction

Patellofemoral pain syndrome (PFPS) is the most common cause of the knee pain in which there is retropatellar or peripatellar knee pain.[1-4] The term "PFPS" is often used interchangeably with "anterior knee pain" or "runner's knee"[1-5] involving the patella and retinaculum that excludes other intraarticular and peripatellar pathology.[1, 6]

Stability of the patellofemoral joint involves dynamic and static stabilizers which control movement of the patella within the trochlea, referred to as "patellar tracking". Patellar tracking can be altered by imbalances in these stabilizing forces affecting the distribution of forces along the patellofemoral articular surface, the patellar and quadriceps tendons and the adjacent soft tissues. Forces on the patella range from between one third and one half of a person's body weight during walking to three times body weight during stair climbing and up to seven times body weight during squatting.[1, 7]

Symptoms are usually of gradual onset.[1] Common symptoms include stiffness or pain or both, on prolonged

sitting with the knees flexed and pain with activities that load the patella femoral joint, such as climbing or descending stairs, squatting, running and kneeling.[1,5,8,9]

Prevalence of patellofemoral pain syndrome is 15% in females which is higher as compared to males in which it is 12%[10]. Females are 2.23 times more affected than males.[11] Incidence rate for patellofemoral pain syndrome is 22/1000 persons per year.[10, 11] Incidence rate of 25% to 43% have been reported in sports person and during basic military training.[10]

Several studies have shown physical therapy to be effective in treating PFPS. A variety of conservative treatments have been suggested like quadriceps strengthening, stretching, braces and straps, electrotherapy, foot orthosis, patellar taping etc. Most patients respond well to conservative interventions. [12-15]

The rehabilitation program should focus on correcting maltracking of the patella by addressing the findings identified on the physical examination.[9] The vastus medialis obliqus (VMO) is of primary importance because weakness of this muscle allows the patella to track too far laterally, which increases patellofemoral joint stress and subsequent articular cartilage wear. To maintain the normal patellofemoral alignment, it is vital to achieve a balanced activity between the VMO and vastus lateralis (VL). Therefore, VMO training has become an integral part of rehabilitation for patients with PFPS.[16, 17]

Patellar taping invented by Jenny McConnell, a Physiotherapist from Australia, who used taping to help patients with patellar maltracking and was effective in reducing the pain.[18-22] McConnell Tape is a rigid, highly adhesive tape that is applied for upto18 hours or less depending on patient's comfort.[18-22]

Hence primary aim of this study was to determine which technique was better to improve pain and function level of the patients with patellofemoral pain syndrome whether vastus medialis obliqus muscle strengthening or patellar taping?

Material and Method

Study design was an experimental study. This study was conducted at a B1 Physiotherapy department, Civil Hospital, Ahmedabad, Gujarat, India. Study duration was of six weeks.

- **Participants**

55 subjects were referred from orthopaedic OPD, Civil hospital, Ahmedabad, out of which, 45 subjects fulfilled the eligibility criteria and 35 subjects were agreed to participate in the study. Subjects were randomly divided into two groups; so in Group A there were 18 subjects and in Group B there were 17 subjects. 3 subjects from Group A and 2 subjects from Group B discontinued the intervention because of social crisis, not ready to come for 6 weeks, got functional recovery, not comfortable to come because of rate of travelling. So total 30 (thirty) subjects were taken for the study with diagnosis of patellofemoral pain syndrome; 10 males and 20 females.

Inclusion criteria were willing to participate in study**,** patient referred to physiotherapy department with primary diagnosis of patellofemoral pain syndrome, age between 17 to 35 years**,** both male and female, having patellar maltracking, pain in one or both knee, had duration of symptoms greater than 4 weeks, had history of insidious onset, not related to trauma and Pain during activities like prolonged sitting, stair climbing, running, kneeling.

Exclusion criteria were history of previous patellar subluxation/dislocation, history of knee surgery or intra articular corticosteroid injection to affected knee joint, knee ligament injury or laxity, infection, malignancy, concomitant diagnosis of peripatellar bursitis or tendonitis, internal knee derangement, plica syndrome, Osgood-Schlatter's disease, any musculoskeletal or neurological lower extremity involvement that interferes with physical activity, pregnancy, low back pain radiating to knee joint and any central/ peripheral neuropathy.

An institutional ethics committee approval was obtained before the commencement of the study. An informed and written consent was obtained from each subject prior to participation in the study. All the subjects were randomly allocated into groups and assessed as per the assessment form.

- **Outcome Measures**

Pre-participation VISUAL ANALOGUE SCALE

(VAS) and KUJALA PATELLOFEMORAL SCALE (KPS) were taken for subjects of both groups. The VAS is a self-assessing questionnaire. It comprises 10 cm line with 0 representing no pain and 10 representing worst pain. The reliability of VAS scoring in the patients with PFPS is established through a number of studies showing ICCs of .60 to .79 for usual pain and .88 for worst pain.[71]The KUJALA scale which is also known as ANTERIOR KNEE PAIN SCALE (AKPS) is a valid and reliable tool in assessing PFPS, which is used to assess knee pain and function. This KPS scoring system is valid in the evaluation of patients with PFPS[23, 24] with an intraclass reliability correlation coefficient range of .90 to .98.[23]

Materials used were consent form, assessment form, visual analogue scale, kujala scale (anterior knee pain scale) ,short wave diathermy machine, firm squeezable ball (circumference of approximately 20 inch), non rigid adhesive hypoallergenic tape, adhesive rigid leukotape p, examination table, stools of different sizes, weight cuff, towel roll, scissor, paper, scale and digital camera.

- **Clinical intervention**

Subjects were randomly divided into two groups for the study; group A received vastus medialis obliqus muscle strengthening with conventional physiotherapy treatment and group B received patellar taping with conventional physiotherapy treatment. Each subject of the study was treated for a period of 6 weeks, 5 times a week. An assessment was done prior to starting of treatment and every 2 week assessment was taken for these subjects.

Conventional physiotherapy treatment given to the subjects of both the groups was in the form of short wave diathermy (SWD), quadriceps setting exercise, straight leg raising, hip abductor strengthening, high sitting quadriceps muscle strengthening, mini squats, forward and side step ups & stretching exercises for gastronemous-soleus, hamstring and tensor fascia lata. **Frequency:** 3 sets of 10 repetitions daily for the first week. if patient is comfortable then progressed to 20 repetitions (2 sets of 10 repetitions per session) during second week and then progressed to 30 repetitions (3 sets of 10 repetitions per session) during third week. Continue with 30 repetitions upto 6 weeks.[25]

Figure-1 Conventional physiotherapy treatment

- **VMO muscle strengthening**

VMO strengthening was done with patient in standing position with back supported. Patient was asked to do squat (40°-60° knee flexion) with hip adduction. A firm squeezable ball, circumference approximately 20 inch, was placed between the knees so that isometric contraction of adductors can be facilitated. The patient was asked to wall slide with squeezing that ball along with squat. During this medial rotation of hip up to 30° was allowed. The association of isometric hip adduction with semi squat exercises produced a more overall quadriceps activity.

Figure-2 VMO muscle strengthening

- **Patellar taping**

In patellar maltracking, lateral shifting of the patella is present. The patellar taping was applied by using the medial gliding technique established by McConnell.

The white non-rigid zinc oxide hypoallergenic tape was applied first directly onto the skin to prevent skin irritation. The Leukotape P, rigid tape was then applied, starting from the lateral femoral condyle, anchoring over the patella, and ending at the posterior knee, with enough medial force applied to shift the patella medially, was used.

Figure-3 Patellar taping

Findings

All the outcome measures (VAS and KPS) were analysed on the 1st day & after completion of training at 6weeks. Results were made using SPSS version 16.0. Wilcoxon Signed Rank Test was applied for with-in group analysis and Mann Whitney 'U' Test was applied for between group analysis.

In this study, there were 10 females and 5 males in each group suggesting there was a female predominance in both the groups. For age distribution among 30 subjects, the mean age of 15 subjects in group A was 30.06 years with a standard deviation (SD) of 4.19 years and mean age of 15 subjects in group B was 29.80 years with a standard deviation of 4.36 years. No significant age difference was seen across the two groups.

Table 1 shows results of Wilcoxon signed rank test for VAS. The Test was applied to both groups for VAS score with-in group analysis which shows there was significant improvement on VAS score in both groups. ($T = 0$, $p < 0.05$)

Table-1 Results of Wilcoxon signed rank test for VAS

Group	Pre Mean ± SD	Post Mean ± SD	Pre Median	Post Median	T value	P value	Result
A	6.4 +2.32	2.0+1.28	6	2	0	0.001	Highly Significant
B	6.47+2.29	2.2+1.47	6	2	0	0.001	Highly Significant

Table 2 shows Results of Wilcoxon signed rank test for KPS. The Test was applied to both groups for KPS score with-in group analysis which shows there was significant improvement on KPS score in both groups ($T = -120$, $p<0.05$).

Table-2 Results of Wilcoxon signed rank test for KPS

Group	Pre Mean ± SD	Post Mean ± SD	Pre Median	Post Median	T value	P value	Result
A	71.13±11.51	92.66±4.56	72	92	-120	0.001	Highly Significant
B	71.73±12.04	91.73±3.69	72	92	-120	0.001	Highly Significant

Table 3 shows results of Mann Whitney test for comparison between group A & B. On comparing group A and group B for post-treatment VAS score and KPS, result shows no significant difference in improvement in terms of VAS and KPS.

Table-3 Results of Mann Whitney test for comparison between Group A & B

Out Come	Group A Mean ± SD	Group B Mean ± SD	Group A Median	Group B Median	U value	P value
POST VAS	2.0 + 1.28	2.2 + 1.47	2	2	103.50	0.699
POST KPS	92.66 + 4.56	91.73 + 3.69	92	92	97.00	0.512

Results indicate that there was significant improvement in pain and function in patients with patellofemoral pain syndrome at the end of 6 weeks in terms of VAS and KPS within both groups. But there was no significant difference regarding improvement in pain and function in patients with patellofemoral pain syndrome at the end of 6 weeks in terms of VAS and KPS between both groups.

It was observed that both VMO muscle strengthening and patellar taping is helpful in improving pain and function in patients with PFPS but the group B which received patellar taping showed faster pain relief and improvement in function compared to group A which received VMO muscle strengthening. However, at the end of 6 weeks both groups did not show significant difference.

Conclusion

It can be concluded that the effect of conventional physiotherapy treatment along with VMO strengthening is similar to the conventional physiotherapy treatment along with patellar taping in improving pain and functional level in patients with patellofemoral pain syndrome at the end of 6 weeks.

Conflict of Interest- There is no any conflict of interest.

Source of Funding – Self

Ethical Clearance – Approval was taken from Institutional Ethics Committee, Government (CL & SC) Spine Institute, Civil Hospital, Ahmedabad.

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