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Effect of Releasing Myofascial Chain in Patients with Patellofemoral Pain Syndrome - A Randomized Clinical Trial

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ABSTRACT

Background: Patellofemoral pain syndrome (PFPS) is characterized by diffuse anterior knee pain. Musculoskeletal dysfunction arises from alterations in the deep fascia that pull or crowd the osseous structures out of alignment resulting in pain and dysfunction. Purpose of the study was to evaluate the effect of releasing myofascial chain in patients with patellofemoral pain syndrome.

Methods: 40 patients were randomly allocated into 2 groups. Experimental group (n=20) mean age 36.60±7.36 was treated with Myofascial chain release and exercise therapy. Control group (n=20) mean age 32.25±9.11 was treated with exercise therapy, three sessions in a week for a period of 4 weeks. Kujala, Visual analogue scale (VAS) and Patient specific functional scale (PSFS) were used as outcome measures. Paired & unpaired t test was used for statistical analysis

Results: Both groups showed statistically significant change in all the three outcome measures. The experimental group showed ($p<0.001$) for Kujala questionnaire, ($p=0.004$) for Patient specific functional scale and ($p<0.001$) for visual analogue scale.

Conclusion: Results suggest that Myofascial chain release showed superior improvement. This is due to the release of interconnected fascia that corrects lower extremity kinematics thereby reducing pain and improving functional activities and reducing the stress on patellofemoral joint.

Key Words: Exercise therapy, Fascia, Myofascial release, Patellofemoral pain syndrome (PFPS), Physical therapy

INTRODUCTION

Patellofemoral pain syndrome (PFPS) is the most prevalent musculoskeletal condition seen in general practice and sports medicine clinics which is characterized as anterior knee pain.[1] The patellofemoral joint is the most heavily loaded in the human frame and its articular cartilage is the thickest.[2] Incidence ranges from 21 to 40% in clinical setting and females are affected more than males in the ratio 2:1.[3] The symptoms include diffuse pain over anterior aspect of knee that is aggravated by activities such as ascending or descending stairs, prolonged sitting and squatting.[4] Physical impairments include destruction of articular cartilage, pain, diminished muscular control, patella mal-alignment, inflexibility of the hamstrings, gastrocnemius, iliotibial band, tensor fasciae latae, and biomechanical alterations in the lower extremity, thus indicating multifactorial causes. The causes and mechanisms involved in patellofemoral pain are extrinsic and intrinsic.[5]

Clinical experience and emerging data proved that weakness of hip musculature and limited lower extremity flexibility are the key factors for the conservative management of patellofemoral pain syndrome.[6] Tight lateral retinaculum causes lateral patellar compression that puts excessive stress on lateral patellofemoral joint. Tight quadriceps becomes less efficient to absorb energy eccentrically which transmits the load to adjacent structures that is patella and quadriceps tendon subjecting them to stress. A tight iliotibial band (ITB) causes increase tension on lateral retinaculum and lateral patellofemoral joint stress. In addition with a tight quadriceps, hamstrings has to overcome this resistance during knee flexion thus generating an increase in patellofemoral joint reaction force.[7]

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In accordance with Fascial Manipulation theory, uncoordinated quadriceps contraction produces anomalous fascial tension in the thigh causing pain in the patella. Therefore the focus of treatment was on the muscular fascia of the thigh.[8] Musculoskeletal dysfunction arise from alterations in the deep fascia.[9] Fascia is tough connective tissue from head to toe spreading throughout the body in a three-dimensional web pattern.[10]

As a response to injury, disease, inactivity or inflammation fascial tissue loses its elasticity and become dehydrated. Fascia binds around traumatized areas causing fibrous adhesions that prevents normal muscle mechanics and decreases soft tissue extensibility. Fascial restrictions crowd or pull the osseous structures out of proper alignment creating abnormal strain patterns, resulting in joint compression producing pain and/or dysfunction.[10]

'Myofascial chain' is the bundled together inseparable nature of muscle tissue (myo) and its accompanying web of connective tissue (fascia).[11] 'Myofascial continuity' describes the connection between two longitudinally adjacent and aligned structures within the structural webbing. Quadriceps runs from ASIS, shaft of femur, then as subpatellar tendon, patella and then continues as Tibialis Anterior towards the inside of the ankle. This Quadriceps, Tibialis anterior chain affects knee tracking. The tensor fascia latae blends with the iliotibial band on the outer aspect of the knee on the lateral condyle of tibia and then onto the tibialis anterior crossing the lower shin bone.[12] Thus Quadriceps, Tibialis Anterior and Iliotibial band chains influence the patellofemoral joint the most.

The current rehabilitation studies for patellofemoral pain syndrome are Kinesio taping, custom-fitted foot orthosis, lumbopelvic manipulation and exercise therapy.[13-16] Exercise therapy has proved effective in management of patellofemoral pain syndrome but has limitations as it doesn't correct the fascial restrictions and a recent systematic review has stated its poor adherence in patients suffering with knee pain due to lack of time, lack of knowledge about the exercise, apathetic condition, poor behavior to exercise and impaired general health status.[17] Despite the success of conservative treatment, patients continue to experience pain and dysfunction making patellofemoral pain syndrome a challenging condition to treat.[18]

Myofascial therapy is defined as "the facilitation of mechanical, neural and psycho physiological adaptive potential as interfaced by the myofascial system". Myofascial release (MFR) is a hands on technique which stretches the fascia and releases, bonds between muscles, integuments and fascia in order to eliminate pain, improve motion and to maintain myofascial balance within the body. [19]

Fascia is manipulated by direct technique that involves the use of knuckles, elbows, ulnar border of the hands and fist, indirect or self-myofascial technique, indirect myofascial release uses hands and the self myofascial release uses a soft roll or ball (tennis ball). The purpose of myofascial release is to focus on the deeper layers of fascia by elongating the muscular elastic component, cross-links and altering the viscosity of ground tissue.[19]

Studies have shown the effectiveness of myofascial release in reducing chronic pain, neck pain, shoulder pain, muscular spasm and muscle tightness.[19] Studies proved the effectiveness of myofascial release on Iliotibial band flexibility and patellar alignment in patients with knee osteoarthritis.[20] Recent study has shown effectiveness of static stretching versus myofascial release in Iliotibial band tightness in long distance runners.[21] Also a recent study have shown the effectiveness of chiropractic mechanical assisted adjusted techniques (MAT), soft tissue therapy involving deep effleurage and myofascial release and specific strengthening and stretching rehabilitation program in a professional basketball player with chronic patellar tendinopathy complicated with patellofemoral pain syndrome.[22]

As inflexibility of soft tissues have been an important factor in causing patellofemoral pain syndrome due to the interconnected fascia, many treatment techniques have been successful in treating patients with patellofemoral pain syndrome but no study has focused on the treatment of muscular fascia involvement. Exercise therapy has been the most effective treatment in patellofemoral pain syndrome. However, myofascial therapy can be an added benefit in order to overcome the poor adherence to exercise therapy. Research on myofascial release has shown promising results in the area of soft tissue inflexibility and could potentially be a form of treatment. As per the existing evidence of soft tissue inflexibility causing patellofemoral pain syndrome. Though the efficacy of myofascial release has been effective in releasing inflexibility of soft tissues, no studies have been retrieved of its effectiveness in patellofemoral pain syndrome patients. Thus the purpose of this study is to know the effect of myofascial chain release compared to exercise therapy on patellofemoral pain syndrome patients.

METHOD

Forty subjects were recruited from Srinivas college of physiotherapy and research center OPD and Srinivas Hospital, Mangalore from April 2016 to March 2017. Inclusion criteria 1) Age between 18-50 years 2) both gender 3) visual analogue scale (VAS) rating of atleast 30mm on a 100mm scale over the previous week. 4) anterior knee or retropatellar pain during atleast three of the following activities like stair ascent or descent, squatting, kneeling, hopping, jumping and prolonged sitting. 5) Gradual onset of symptoms 6) Subject experiences pain during palpation of patellar facets or while performing a 25-cm step down test or double legged squat.[3,6] Exclusion criteria included meniscal or intra-articular pathological conditions, cruciate or collateral ligaments involvement, tenderness over the patellar tendon, iliotibial band or pes anserinus tendons, sign of patellar apprehension, patellar tendinopathy, hip or lumbar referred pain, history of patellar dislocation, evidence of knee joint effusion, history of previous surgery, pre-patellar tendinitis, fat pad bursitis, quadriceps tendinopathy, over sensitive patients, systemic or local infections, healing fractures, anti-coagulant therapy and under corticosteroids and or anti-inflammatory drugs.

PROCEDURE

The approval was obtained from the scientific committee and college ethical committee. Subjects with patellofemoral pain syndrome were screened for inclusion and exclusion criterion. A total of 53 subjects were screened. 40 subjects met the inclusion criteria. The purpose of the study was explained to all the subjects and was asked to sign the written consent form stating the voluntary acceptance to participate in this study. Demographic information was collected. Purposive sampling was done. 40 subjects were assigned randomly into experimental or control groups by block randomization. Pre -treatment score was evaluated by using Kujala Questionnaire [23], Patient specific functional scale [24] and visual analogue scale[25]. Experimental group (n=20) was treated with myofascial chain release for the Quadriceps, Iliotibial band and Tibialis anterior muscle along with exercise therapy. Control group (n=20) was treated with exercise therapy that included stretching and strengthening of hip and knee musculature. Treatment was given for 3 days in a week for a period of 4 weeks. Post treatment score were evaluated after the last treatment session

DESCRIPTION OF TREATMENT

Brief assessment was conducted.

Evaluation of fascial restriction was assessed using the therapists elbow. Any restrictions felt were assessed and given treatment.

Experimental group**:** Myofascial chain release and exercise therapy

Myofascial chain release- [26]

Position of the patient- Supine lying, prone lying and side lying

Position of the therapist- Side of the patient limb to be treated

Technique-Using the therapist elbow a vertical release proximal to the attachment of the muscle belly or fascia was applied.

Once an end-feel was reached a slow stroke down the length of the target tissue was performed along with monitoring the indirect feedback and tissue tension to identify any additional restrictions.

The long stroke was repeated in a line parallel to the first stroke. It was continued until an end-feel is reached throughout the entire muscle belly or fascia on the most restricted/painful points.

Myofascial chain release was given to Quadriceps, Iliotibial band and Tibialis anterior for three days in a week for a period of four weeks of 5 to 10 min duration.[16]

Figures 1: Myofascial chain release for Quadriceps.

Exercise therapy-[13]

Table 1: Exercise therapy

Exercise treatment protocol	Repetitions (reps)
Stretching of hamstrings, plantar flexors, quadriceps, iliotibial band	3 reps with 30 second each
Iliopsoas strengthening in non-weight bearing	3 sets with 10 reps each
Seated knee extension 90-45 degree	3 sets with 10 reps each
Leg press and squatting 0-45 degree	3 sets with 10 reps each
Hip abduction against elastic band(standing) & with weights (side-lying)	3 sets with 10 reps each
Hip external rotation against elastic band(sitting)	3 sets with 10 reps each
Side-stepping against elastic band	3 sets with 10 reps each

Maximum resistance were given that enables 10 repetitions

Load was 70% of the 1-repetition maximum.

Treatment was given for 3 days in a week for a period of 4 weeks, total 12 sessions.

STATISTICAL ANALYSIS[27, 28]

Descriptive analysis was done by finding mean and standard deviation. The data was then subjected to test of normality. Data was analysed using Paired t-test to compare the outcomes within the group and Unpaired t- test for between the groups. The confidence interval was kept at 95%.

RESULT

Table 2: Patient baseline status

Variable	Experimental group (n=20)	Control group (n=20)
Age	36.60±7.36	32.25±9.11
Kujala questionnaire pre	83.05±2.98	75.00±6.11
PSFS pre	4.99±1.16	3.39±1.34
VAS pre	6.10±0.91	6.85±1.03

ANALYSIS ON KUJALA QUESTIONNAIRE

Table 3: Statistical values of Kujala

		Mean±SD	Within groups	Between groups
Experimental Group	Pre	83.05±2.98	9.95±2.35 (P<0.001)	P<0.001
	Post	93.00±2.79		
Control group	Pre	75.00±6.11	7.85±6.34 (P<0.001)	
	Post	82.85±4.42		

Both groups showed a statistically highly significant change (*P* <0.001) which means that both the groups significantly reported improved functional activity. However when analyzed between the post intervention value of experimental group and control group, it showed a statistically significant change (*P*<0.001) showing that experimental group had superior improvements in functional activity than control group.

ANALYSIS ON PATIENT SPECIFIC FUNCTIONAL SCALE

Table 4: Statistical values of Patient specific functional scale

		Mean±SD	Within groups	Between groups
Experimental Group	Pre	4.99±1.16	1.21±1.54(p=0.002)	P=0.004
	Post	6.21±1.38		
Control group	Pre	3.39±1.34	1.58±0.96 (p=0.002)	
	Post	4.97±1.10		

Both groups showed a statistically significant change (*P*=0.002) which implied that both the groups had favourable outcome in functional activity levels. Patient specific functional scale was analyzed between post intervention value of experimental group and control group, it showed a statistically significant change (*P=0.004*) showing that experimental group had superior improvements in functional activity than control group.

ANALYSIS ON VISUAL ANALOGUE SCALE

Table 5: Statistical values of visual analogue scale

		Mean±SD	Within groups	Between groups
Experimental Group	Pre	6.10±0.91	2.85±0.67 (*P* <0.001)	*P* <0.001
	Post	3.25±0.96		
Control group	Pre	6.85±1.03	1.80±0.76(*P*<0.001)	
	Post	5.05±1.19		

Both groups showed a statistically highly significant change (*P* <0.001) for reduction in pain. Visual analogue scale when analyzed between the groups, it showed that there was statistically significant change (*P* <0.001) showing that experimental group had superior improvements in reducing pain than control group.

DISCUSSION

Study was conducted to evaluate the effect of releasing the myofascial chain in patients with patellofemoral pain syndrome. Conservative management has focused on hip muscle weakness and inflexibility of lower extremity muscles as it has been the common factors causing patellofemoral pain syndrome.[6] Travell and Simons have stated that chronic overload of the lower extremity muscles is the prime problem without gross abnormality of the articular cartilage for the development of patellofemoral pain syndrome. As inflexibility of soft tissues have been an important factor in causing patellofemoral pain syndrome due to the interconnected fascia and due to the multifactorial causes many treatment techniques have been successful in treating patients with patellofemoral pain syndrome but had limitations as it did not focus on the treatment on muscular fascia involvement. To the best of the author's knowledge there were no clinical trial done on the treatment of releasing the myofascial chain in patients with patellofemoral pain syndrome.

Fascia is a complex structure that connects throughout the body. Fascia allows for effective load transfer between the spine, pelvis, legs and arms. Fascia is continuous, has pain fibers and is capable of transmitting tension. The hip muscles form a vital link in the lower extremity kinetic chain transferring ground-reaction forces from the legs to the trunk during gait.[29]

This study had myofascial release therapy along with exercise therapy in the experimental group and exercise therapy alone in the control group. A pure control group with no treatment or a pure experimental group with no conventional treatment could not be taken based on ethical grounds. Exercise therapy included stretching and strengthening exercises for the lower extremity as it has been proved as the most effective conventional treatment for the management of patellofemoral pain syndrome in reducing pain as well as improving functional dynamic activities. It was stated that since it focused on pelvis and hip muscle recruitment the patients had better hip motor control during the exercises and weight bearing functional activities.[16] The lower extremity kinematics improved during functional activities because movement patterns were executed more correctly and thus reducing stress on patellofemoral joint and consequently decreasing pain. Relaxing and stretching tight and shortened postural muscles along with strengthening the weaker, inhibited phasic muscles helped in balancing postural and phasic muscle activity as well as joint mobility of the lower extremity and pelvis bony articulations thereby improving the patellofemoral function.

The results in the study showed that both the groups showed similar improvements. However experimental group showed superior improvement than control group, stating that the experimental group had an added effect for reducing pain and improving functional activity. Hence the hypothesis is been rejected.

The better improvement in experimental group was due to the direct focused treatment to the muscles that showed inflexibilty. Release of interconnected fascia corrected lower extremity kinematics and movement patterns thus reducing stress on the patellofemoral joint. Likewise Gate control theory interferes with the transmission of painful stimuli thus closing the gate to the brain's perception of pain. Interpersonal attention refers to the hands on, individualized attention. This personal attention and human touch has a calming effect that decreases the perception of pain which relates to the parasympathetic response of the nervous system. Stimulaton of parasympathetic response decreases the release of stress, anxiety, depression and pain. Release of serotonin blocks the transmission of noxious stimuli to the brain.[30] Thus it has been demonstrated that myofascial release techniques are beneficial for individuals recovering from myofascial injuries and thereby reducing musculoskeletal pain.

CONCLUSION

Both experimental group and control group reported significant improvement in all the three outcome variables. However experimental group showed superior improvement demonstrating that it had an added effect in reducing pain and improving functional activity in patients with patellofemoral pain syndrome.

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