

Research article

**Effect of kinetic exercises versus isometric exercises among patellofemoral arthritis patients:
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ABSTRACT

Introduction and Aim: Patellofemoral arthritis (PFOA) is one of the most common causes of anterior knee pain in adults and is more common in women than men. The aim of the study was to investigate the effect of kinetic chain exercises versus isometric exercises and to reduce the pain and improve the quality of Life.

Materials and Methods: The present study was conducted in a physiotherapy clinic. For the comparative experimental study, 30 subjects were taken in each group and the total duration of the study was 6 weeks (30 minutes duration /once a day /5 day a week) from June 2022 to mid-August 2022. Method of sampling was a purposive sampling technique.

Results: Numerical pain rating scale (NPRS) Kujala Scoring Questionnaire (Anterior knee pain scale).

Conclusion: From the data obtained it was evident that the kinetic chain exercise group patients showed marked improvement than group B.

Keywords: PFOA; Quality of life; Numerical pain rating scale; Kinetic chain exercises.

INTRODUCTION

In human's knee joint is one of the major joints, comprising three joints namely, medial tibiofemoral, lateral tibiofemoral and patellofemoral. Knee osteoarthritis is commonly disturbing more females than males. Isolated patellofemoral arthritis is a common disorder, and much research is going on to find out treatment. It is due to loss of cartilage of the patella and trochlea of femur, and this is classified as degenerative arthritis (1). Noble and Hamblen stated in a cadaver study that 79% of 100 cadavers had this patellofemoral arthritis (PFOA) and aged ≥ 65 years.

There are many causes for this dysfunction that treatment also is a challenging one. Valgus knee alignment accelerates lateral patellofemoral arthritis and dysplasia of the patella or trochlea, malrotation of the tibia. The altered quadriceps muscle force is also one of the causes (2,3).

The main function of the patella is thought to be improving the mechanical advantage of the quadriceps extensor mechanism by increasing the lever arm of the muscle. The patella also acts to dissipate the forces generated in the patella tendon during knee flexion and extension. The patellofemoral joint is a unique and complex structure consisting of elements (ligaments and bones) and dynamic elements (neuromuscular system). The primary soft tissue stability of the joint is provided by the medial and lateral patellofemoral and patellotibial complexes.

The stability of the joint is also influenced by lower limb alignment including varus/valgus femorotibial

alignment and rotational variances of the femur. In addition, the relation of the knee to the pelvic position and strength is another important stabilizer for the knee. Therefore, patellofemoral joint abnormality can be associated with one or combination of these factors (4).

Patellofemoral arthritis results from the loss of articular cartilage of the patella and the trochlear groove and chondral wear is most prevalent in the lateral patellar facet. This indicates that the lateral patellar facet is more often overloaded than the central or medial aspect of the patella. The patellofemoral joint is affected by the extensor mechanism of the knee including the quadriceps, femoris, patellar bone, and ligaments. Malalignment of the extensor mechanism can result in anterior knee pain due to overload on the lateral aspect of the knee, patellar subluxation or tilt, abnormal Q-angle, or torsion of the distal femur, all of which are good indications for tibial tubercle osteotomy or patellofemoral joint replacement (5). Degeneration of the patellofemoral joint can develop secondary to abnormal stress on the patella caused by patella alta, increased Q-angle combined with secondary soft tissue problems, a weakened or hypoplastic vastus medialis oblique combined with contracture of the lateral retinaculum, or deficiency of the medial patellofemoral ligament (6).

The main aim is to find out the effectiveness of kinetic chain exercises in patellofemoral arthritis. The objective of this study is the effectiveness of kinetic exercises in PFOA with isometric exercises. There are many interventions used in treatment of PFOA

which includes modalities, exercises, braces, etc., in that aspect kinetic chain exercises were beneficial in reducing pain, improving muscle strength, and improving ADL. So, this study is to confirm the efficiency of kinetic exercises among PFOA patients.

MATERIALS AND METHODS

The study participants were recruited from a Chennai based physiotherapy clinical setup. Among the 60 participants 30 were randomly assigned in each group, that is in the control group ($n = 30$) and in the experimental group ($n = 30$) respectively. The inclusion criteria for the recruitment were (1) aged between 40 to 50 years (2) Both the male and female gender (3) NPRS more than or equal to 5 (4) Pain lasts for 4 -6 weeks. Participants were excluded if they (1) have undergone previous knee surgery (2) h/o lower limb fractures (3) had any musculoskeletal disorders (4) injury to the knee ligaments (5) deformities either congenital or acquired.

Methodology

Subjects were briefed about the uses and effects of the procedure and got consent. Sixty subjects were selected randomly and divided into two groups, each 30 in 2 groups. As a pre and post-test NPRS and Kujala score were used as an outcome measure. Group A was given with semi squat, stationary cycling, knee flexion and extension in high sitting, knee extensor exercise with weights, isometrics exercise for quadriceps, 20-degree SLR and adductors squeeze with wax bath. Each exercise was carried out with 10 sec hold time/30 rep. Each set was for 10 times followed by 30 seconds' rest. This exercise was given twice a day for 6 weeks. Wax bath given prior to exercise session. Group B was given static quadriceps and wax bath which was proved by previous studies as conventional therapy. After 6 weeks of intervention pain and function was assessed using NPRS scale and Kujala score.

RESULTS

In this study the kinetic exercise group consisted of a total of 30 subjects which included a greater number of females than males. Male: 5 (16.66%); Female: 25 (83.33%); Total; 30; Unilateral involvement: 90% (27/30), Bilateral involvement: 10% (3/30).

Table 1: Pain NPRS scale kinetic group A

Group A	Pre-Test	Post-Test
Mean	6.73	2.43
SD	0.94	0.82
SEM	0.17	0.15
n	30	30

NPRS scale kinetic group A

Pre and post-test group mean was 4.30. P value is less than <.0001 and statistically significant. Pre-test score mean was more than post-test score for NPRS scale which showed that kinetic exercises markedly reduced

pain (Table 1).

Data analysis

The collected data were analyzed using paired tests and obtained results are as follows: Kujala test pre and post-test group mean was 34.17. P value less than .0001 and it is statistically significant. Group mean for Kujala score showed marked changes after intervention which proved the effect of kinetic chain exercise (Table 2).

Table 2: Kujala scale kinetic group A

Group A	Pre-test	Post-test
Mean	45.57	79.73
SD	16.94	8.13
SEM	3.09	1.48
n	30	30

Kujala and NPRS for Isometric exercise group (B) data analysis

Total number: 30; Male: 8 (26.6%); Female: 22 (73.3%); unilateral involvement: 27/30 (90%); Bilateral involvement; 3/30(10%). The data obtained were analyzed using paired t tests and p value obtained was <.0001 and statistically significant, the mean obtained was 5.03. When compared with the kinetic chain exercises group the value obtained is less and hence proves that isometric exercise is less effective for PFOA (Table 3).

Table 3: Data analysis for Kujala score, group B

Group B	Kujala score		NPRS	
	Pre-test	Post-test	Pre-test	Post-test
Mean	48.63	51.67	6.77	3.83
SD	14.63	11.53	0.97	0.70
SEM	2.67	2.10	0.18	0.13
n	30	30	30	30

The mean value for pre and post-test for Kujala score was 5.03.

The two-tailed P value was <0.0001 and statistically significant. When compared between groups using unpaired 't' test, group A (kinetic chain exercises group) showed much difference in pre and post-test values of Kujala and NPRS score (Table 4).

Table 4: Group analysis

Group	Group A	Group B
Mean	34.17	5.03
SD	2.052	0.975
SEM	0.374	0.178
n	30	30

DISCUSSION

The mean of Kujala and NPRS score was analyzed and concluded that p value was <0.0001 which was statistically significant.

Karart *et al.*, reported that both CKC and OKC were effective in reducing pain in OA knee. In this study also kinetic chain exercises were effective in reducing

pain and improving quality than group B group. It is proved by Kujala score (7). Van Linschoten *et al.*, showed in their RCT that the exercise group got pain relief and improved performance. Here in this study also the kinetic exercises group was improved noticeably (8).

Minoonejad *et al.*, conducted a study on the effect of open and closed kinetic chain vs Control group and they proved that kinetic exercises showed marked decrease in pain and improved ADL. In the present study, group A was treated with kinetic chain exercises that showed a marked change in values and proved the effect of kinetic exercises more than group B (9).

Individually programmed conservative management based on post isometric exercises techniques and patellar mobilization were effective therapy for reducing patellofemoral pain syndrome. It was proved by Alarab *et al.*, The present study also proved that the kinetic exercises which include various exercises like isometric, isotonic and strengthening exercises improved pain and functional score (10).

Suresh Kumar *et al.*, in their RCT study on kinetic chain exercise for patellofemoral pain syndrome showed that both OKC and CKC seems to be effective in reducing pain, improving muscle strength and function. The present study also showed a marked improvement over group B (11).

Moyano *et al.*, conducted a study on effectiveness of various exercises for PFOA and concluded that exercise groups showed good change in pain and disability. Here, the kinetic chain exercise group gave better results compared to group B (12). Jamshidi conducted a RCT with kinetic chain exercise vs group B group. And found group B group demonstrated significant increase in pain and open and closed kinetic chain exercise program improved subjective and clinical outcomes in the patients with patellofemoral pain syndrome. The present study kinetic exercises group improved with pain and functional activities than group B group after 6 weeks of intervention (5).

Limitation of the study

Here for group B, wax bath and static quadriceps alone given which was proved several times and in practice as physiotherapy interventions for PFOA. In future, study may be done with placebo to prove the effectiveness of kinetic exercises. Follow up is needed for a long duration like 10 to 12 weeks instead of 6 weeks. Population was small in this study.

CONCLUSION

With this present study it was confirmed that kinetic chain exercise, both open kinetic and closed kinetic chain exercises gave good pain relief and functional score, and it was proved by outcome measure NPRS and Kujala score. Considering the results of this study,

for PFOA, kinetic exercises would be given to improve pain and functional activities.

CONFLICT OF INTEREST

Authors declare no conflicts of interest.

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