

Efficacy of Proprioceptive Exercises and Core Strengthening with Conventional Physiotherapy on Pain and Quality of Life in Knee Osteoarthritis

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ABSTRACT

Background: The osteoarthritis is the commonest form of musculoskeletal disorder affecting weight bearing joint, caused by destruction of articular cartilage, OA is leading cause of disability among older adults.

Methodology: 40 male & female subjects Age between 45 to 55 years with knee pain and first and second grade OA, randomly divided into 2 Groups (Proprioception circuit exercise & core stability exercise) the outcome measure was KOOS scale focused on pain & QOL,

Results: The mean value for Group A, pre-Pain 42.95 and Pre QOL was 38.30, and in Group B, Pre pain was 43.10 and Post pain was 58.50, and Pre QOL 36.40, and Post QOL 57.15, The Group B, shows significant changes with P value ($p=0.001$) on pain and ($p=0.001$).

Conclusion: The study shows significant improvement on basis of pain and QOL, in both the Groups, But the Group B, had significant improvement in patient with OA, knee.

Keywords: Proprioception circuit exercise, Core stability exercise, Knee osteoarthritis outcome score (KOOS), OA knee.

INTRODUCTION

Arthritis is inflammation of joints, and common types of arthritis are rheumatic, rheumatoid, osteoarthritis, and tubercular. Osteoarthritis is a traditionally a wear and tear process leading to a degenerative non inflammatory joint disease of one or more joints. In India, arthritic changes in knee

joint are the most common form of Osteoarthritis.¹

Osteoarthritis represents the ageing process where; the articular cartilage shows various degenerative changes. The pathogenesis of OA involves a degradation of cartilage and remodeling of bone due to an active response of chondrocytes in the articular cartilage and the inflammatory cells in surrounding tissues. Following destruction, there occurs Fibrillation of cartilage (degenerative change in the centre) resulting into Osteophyte formation (proliferative change around the edge) and lipping of the joint (formation of the edge).²

The overall prevalence of Knee OA in India ranges from 22-39%. It affects women more than the men, but prevalence dramatically increases with age. Studies have shown that after the age of 65, 45% of women are OA symptomatic and 70% show radiological evidences.³

It is caused by a variety of factors which includes many parameters as, family history, obesity, hypermobility, and many biomechanical mal-alignment factors as trauma, occupational injuries which is due to abnormal joint loading, heavy lifting, kneeling and squatting etc. Additional to the causes there are certain risk factors which enhance the chances of OA, i.e. knee surgeries, genetic history.⁴

The involved joint is commonly swollen and joint movements are restricted and painful.

Predominant symptom is pain which increases on walking. Patient has mild swelling and complaints of early morning stiffness, minimal tenderness and coarse crepitus can be elicited. Patient gives history of locking or giving way. Terminal movement of the knee are restricted. Also it was found that there is impaired proprioception that leads to the progression of knee pain and activity restriction.⁵

Diagnosis of Knee osteoarthritis is usually confirmed by history, physical examination, imaging studies and rarely by laboratory testing. Physical examination involves inspection, palpation, ROM testing and special tests such as ligament stability test, meniscal test and gait analysis.⁶

Treatment of OA usually involves patient's education regarding the condition, lifestyle modification, weight management for obese individual, pharmacotherapy (NSAIDs, glucocorticoids and opioids) and physiotherapy is the mainstay of the treatment. It involves electrotherapy (ultrasound, muscle stimulation), thermotherapy, stretching and strengthening exercises. Also supporting devices are used such as orthosis.⁶

Impaired proprioception results in weakening of lower limb musculature, reduce walking ability and dynamic balance of a person. Also it had direct impact on the knee pain associated with OA.⁷

Proprioceptive training is type of weight bearing intervention based on functional task that is responsible for restoration of proprioceptive responses.⁸ Proprioceptive process helps to alter muscle contraction in response to external force information. Proprioceptive reactions permit compensatory modifications in lengths of different muscles, their pressure levels, the position of the joints to encourage movements, improves mobility and pain.⁵

Core region is a muscular part comprising diaphragm on the top, pelvic floor and hip muscles in the bottom, abdominals anteriorly and posteriorly paraspinals and gluteal muscles.⁹ Core muscles stability is crucial regarding the stability of spine

during the dynamic and static task.¹⁰ It acts as a link between the upper and lower limb functioning.⁹ Core muscle weakness results in increased load on knee joint and its contact during walking.¹⁰ Core muscle strengthening involves activation of functional kinetic chain that connects the stability of the lower extremities via the abdominal fascial system.⁷

KOOS scoring is tool used to evaluate the patient's Knee and its associated problems. KOOS score stands for The Knee injury and Osteoarthritis Outcome Score. It consists of five sub scale that are Pain, symptoms, ADL, Sports/Recreational activities and Quality of Life. Each subscale involves items related to task involving knee use. Total of 42 items are present in 5 subscales. Each item has 0-4 scoring in which 0 means extreme problem and 4 means extreme problem. Total score of all subscale ranges between 0-100.¹²

Osteoarthritis is one of the most disabling musculoskeletal problems of middle age or above. The major disability associated with osteoarthritis knee is pain and difficulty in activity of daily living and decreased quality of life. The evidence suggests that there is a marked proprioceptive deficit with knee osteoarthritis. There are worldwide researches on training/treatment protocol for osteoarthritis including the proprioceptive exercises and core strengthening exercise individually. But there is very low literature/research data to compare the efficacy of proprioceptive exercises and core strengthening exercise. So the need to study arised and the present study was proposed to stabilize the effective treatment protocol for knee OA. We hypothesized that there would be a significant difference between the effect of proprioceptive and core strengthening exercise of patient with OA knee on pain.

The aim of the study was to evaluate the efficacy of proprioceptive exercises and core strengthening along with conventional physiotherapy on pain and quality of life in knee osteoarthritis

MATERIALS & METHODS

The study was approved by institutional Ethical committee. We included male and female patients with osteoarthritic knee pain from Trilanga, Bhopal. Data was collected from Department of physiotherapy, Rajeev Gandhi College, Bhopal.

SAMPLING CRITERIA

We included Males and females subjects of age between 45 to 55years with osteoarthritic pain., tightness of quadriceps and hamstring muscles, Clinical and Radiological evidence of knee OA of grade 1 & grade 2, Subjects with spinal deformities, ankle joint and knee joint injury, old fracture around knee joint with mal alignment, any active infection around knee joint with mal-alignment, pes planus, L.L.D, OA of grade 3 & grade 4, Morbidly obese patient, Cardio-Respiratory disorders & peripheral vascular disease were excluded from the study.

PROCEDURE

In the present study, pre-test and post-test patterned 40 patients with osteoarthritis knee pain actively participated. Exercise protocols were clearly explained and demonstrated to every participant. The proprioception exercises along with conventional exercises were implemented on group A (n=20), while the core stability exercises along with conventional exercises were implemented on group B (n=20). Conventional exercises included isometric exercise of quadriceps and hamstring and iliotibial band stretching. Before the protocol implementations, pre-test KOOS measurement was carried out. During the treatment duration of 4 weeks, respective core stability exercises along with conventional exercises and proprioception exercises along with conventional exercises were implemented on both groups in a sequential progressive manner. In the initial first week, 1 set of each exercise was given, which is progressed later as 2 sets of each exercise in 2nd week. Sequentially it was progressed to 3 and 4 sets in the next 3rd and

4th weeks. After 4 weeks, post-test KOOS group measurement was carried-out. Proprioceptive exercise protocol has been presented in Table 1, whereas core stability exercise is presented in table 2

Table 1 - Group A protocol: - Proprioceptive circuit exercise

S. NO.	Exercise	Set × repetitions	Frequency
1.	Half squat	1×10	Once a day
2.	Side lunge	1×10	Once a day
3.	Straight lunge	1×10	Once a day
4.	One leg raise	1×10	Once a day

- 1. Half Squat-** in this exercise, patient is asked to stand in straight standing position with legs slightly wider than shoulder width, and then bend their knees to the half squat position. When patient goes down, she holds the flexed knee position for 10 seconds.
- 2. Side Lunge-** in this exercise, patient is asked to stand in straight standing position with legs slightly wider than shoulder width and toes pointed towards the lateral side of the exercising limb. The patient is then commanded to shift body weight to one leg bending the knee until it reaches 90-degree angle at knee & hip joint, other leg is kept straight asking the patient to hold this position for 10 seconds and then relax. This procedure was repeated for 10 repetitions in 1 set.
- 3. Straight lunge-** in this exercise, patient is asked to stand in straight standing position with legs slightly wider than shoulder width and toes pointed forward. Then patient is commanded to shift body weight to one leg bending the knee until joint reaches a 90-degree angle at knee and hip joint other leg is kept straight. ask the patient to hold this position for 10 second then relax. This procedure was repeated for 10 repetitions in 1 set.
- 4. One leg raise-** In this exercise the patient is asked to stand in straight standing position with legs slightly wider than shoulder width and toes pointed forward. Then patient is commanded to lift right leg off the floor keeping back straight and the knee

slightly bend, holding your right foot a few inches above the ground. Lift the leg as high towards about 45 degrees with the floor.

Table 2 – Group B Core Stability Exercise

S.NO	Exercise	Set × Repetitions	Frequency
1.	Bridging	1×10	Once a day
2.	Abdominal isometrics	1×10	Once a day

- 1. Bridging** – patient is asked Lie straight on the back with his hands kept at the sides, knees bent and feet flat on the floor under the knees keeping the distance of hip width apart (hook lying position). we commanded patient to tighten the abdominal and buttock muscles, followed by raising the buttock up off the floor until his upper body and thigh from a straight line with each other. Ask the patient to hold this position for 10 seconds and then relax.
- 2. Abdominal isometrics-** patient is asked to Lie straight on the back with his hands kept at the sides, knees bent and feet flat on the floor under the knees keeping the distance of hip width apart (hook lying position). we commanded the patient to tighten the abdominal muscles, tuck in the belly button downwards, and try to press the couch downwards, with the abdomen.

STATISTICAL ANALYSIS

The data was analysed using SPSS version 17. Both the groups had 20 subjects each and each subject was assessed by KOOS scale pre and post treatment. As number of patients in each subject was 20(<50), therefore Shapiro-Wilk test was used in the study.

To determine the significance of data of Group A and Group B normality test was done which showed significant values i.e. more than 0.05. Therefore, in the present study both the group A and B were analysed using parametric test. Student’s t-test was applied to compare group and pre post values of KOOS score in our participants.

RESULT

Following tables shows the results of our study

Table 3: Comparison of Mean Values of Group A using Paired t-test.

KOOS	N	Mean	S.D.	t=Value	p=Value
Pre-Pain	20	42.95	2.18	-15.88	0.001
Post-Pain	20	55.40	2.83		
Pre-QOL	20	38.30	2.23	-34.79	0.001
Post-QOL	20	62.15	2.18		

The above table shows, baseline pain of subjects was 42.95±2.18 on KOOS Knee Survey. The pain of subjects following 4 weeks training session was 55.40±2.83 on KOOS Knee Survey. The baseline QOL of subjects was 38.30±2.23 on KOOS Knee Survey. The QOL of subjects following 4 weeks training session was 62.15±2.18 on KOOS Knee Survey. After training Paired t-test was applied and statistically significant difference was found in pain and quality of life as compared to baseline i.e p=value for pain and quality of life is 0.001.

Table 4: Comparison of Mean Values of Group B using Paired t-Test.

KOOS	N	Mean	S.D.	t=value	p=value
Pre-Pain	20	43.10	2.10	-28.78	0.001
Post-Pain	20	58.50	1.90		
Pre-QOL	20	36.40	3.51	-17.06	0.001
Post-QOL	20	57.15	4.51		

The above table shows, baseline pain of subjects was 43.10±2.10 on KOOS Knee Survey. The pain of subjects following 4 weeks training session was 58.50±1.90 on KOOS Knee Survey. The baseline QOL of subjects was 36.40±3.51 on KOOS Knee Survey. The QOL of subjects following 4 weeks training session was 57.15±4.51 on KOOS Knee Survey. After training Paired t-test was applied and statistically significant difference was found in pain and quality of life as compared to baseline i.e. p=value for pain and quality of life is 0.001.

Table 5: Comparison of Mean Values of Group A and B using Student t-Test

KOOS	N	Mean	S.D.	t=value	2-tailed
Pre-Pain	40	43.02	2.14	-0.22	0.82
Post-Pain	40	56.95	2.36	-4.06	0.001
Pre-QOL	40	37.35	2.87	2.04	0.51
Post-QOL	40	59.65	3.34	4.46	0.001

Levene' test (Independent t-test) was used to calculate the difference of means of KOOS Pain and Quality of Life between the two groups. At baseline, there was no statistical difference between the pain of subjects of two groups ($p=0.82$), while that after 4 weeks, the difference was statistically significant ($p=0.001$). Also, the baseline data of QOL of two group showed insignificant result ($p=0.51$) and after 4 weeks of treatment protocol, the difference was significant ($p=0.001$).

DISCUSSION

Present study focuses on the efficacy of Proprioceptive circuit training and core stability exercises on pain and QOL in knee osteoarthritis. It was conducted on 40 patients with osteoarthritis knee. The patients were randomly allocated in to two groups by means of Simple Random Sampling method. The proprioceptive exercises along with conventional exercises were implemented on group A, once a day for 4 weeks and the core stability exercises along with conventional exercises were implemented on group B, once a day for 4 weeks. Before this treatment intervention, the pre KOOS measurement was carried out and after 4 weeks, the same test was carried out again "post test". Then the readings are analysed by means of SPSS software version 17.

When we compared the pre KOOS values of group A and group B, we found no significant difference between pre values of group A and group B, which means that both the groups were similar at baseline. It indicates that both groups have nearly similar pain and QOL prior to the treatment. When we compared the pre and post values of pain and QOL of group A using paired t-test, a significant difference was obtained between the two sessions. When we compared the pre and post values of pain and QOL of group B using paired t-test, a significant difference was also obtained between the two sessions. But, when we compare the post values of pain and QOL in between group A and group B; Group A

was found more significant for improving the QOL and Group B were more significant for reduction in pain It means that proprioceptive circuit training exercises are found more effective in improving QOL in OA knee patients, whereas, core stability exercises are more effective in reducing pain in OA knee patients. Proprioceptive exercises help in improving postural sway and isokinetic strength, leading to improvement in joint stability of lower limb which in further increases the QOL of an individual. The core strengthening exercises helps in better reduction of pain because it rectifies the improper recruitment of the muscles. Various previous studies have shown that different techniques are effective in OA knee patients like Ju et al in their study concluded that Proprioceptive exercise programme can be an effective way to strengthen knee joint muscle function. Binti et al., 2015 studied core stability deficits in male & female knee osteoarthritis patients, and demonstrated that core muscles strengthening should be incorporated in physical rehabilitation program for knee osteoarthritis. Ju et.al, 2015 had suggested proprioceptive circuit exercise is significant in subjects with knee osteoarthritis. Authors have concluded that proprioceptive exercise program can be an effective way to strengthen knee joint muscle function and also reduces pain in osteoarthritis. Kirthika et al; 2019 has overseen A double blinded two group pretest posttest design efficacy of combined proprioceptive exercises and conventional physiotherapy in patients with knee osteoarthritis. The present study concluded that 3 months duration of combining proprioceptive exercises with conventional physiotherapy is more effective than conventional alone. Joshi et al; 2019 has conducted a study on the effects of Correlation of core muscle endurance and balance in subjects with knee osteoarthritis. There is a weak to moderate correlation between core endurance and balance in subjects with OA knee. Goldring et al;2006 had suggested the pathophysiological changes over the span of

arthritic changes in OA Knee, the clinical presentation demonstrates cardinal signs of inflammation mostly pain, restriction of joint movement and functional impairment. In later phase of the condition synovitis is common clinical presentation with articular cartilage destruction, and osteophytes formation. Michael et al; 2010 the suggested causes diagnosis and factors influencing the condition and management of KOA. Osteoarthritis is not yet a curable disease and its pathogenesis remains unclear. The best treatment for osteoarthritis of the knee is prevention. Singh et al; 2016 has overseen epidemiology of knee osteoarthritis in India and related factors. this is scarcity of studies done in India which has varied socio geographical back ground and communities. This study has evidenced a large percentage of population as border line osteoarthritis. Although there were some limitations in our study that proprioceptive exercises were not done on different surfaces and core stability exercises were not done on individual muscles. So, it is suggested that further study should be carried out to address these limitations.

CONCLUSION

The results of this study showed that both techniques are showing beneficial for the improvement in symptoms of OA. But the results showed that proprioception circuit exercise demonstrate more significant improvement in quality of life while the core stability exercise helps in the reduction of pain in knee OA patients.

Declaration by Authors

Ethical Approval: Approved

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Conflict of Interest: The authors declare no conflict of interest.

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