Original Research

Comparative effects of balance exercise and routine physical therapy exercise on knee function and fall risk in patients with knee osteoarthritis

Munazza Waseem[a], Asma Sattar[b], Sidra Majeed[c], Satwat-Ul-Islam[d]

[a] Department of Physical Therapy, Abwa Medical College Khurrianwala Faisalabad, Pakistan

[b] Department of Physical Therapy, KAIMS International Institute Multan, Pakistan

[c] Department of Rehabilitation Sciences, The University of Faisalabad, Pakistan

[d] Department of Allied Health Sciences, University of Sargodha, Pakistan

Abstract

Correspondence:
Satwattalha@gmail.com

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The most common musculoskeletal disease is knee osteoarthritis among older people. This disease can lead to postural impairments, causing instability, which reduces balance and increases the patient's risk of falling as the disease progresses. This study aimed to evaluate the effects of knee strengthening exercises on reducing the risk of falls among knee osteoarthritis patients. The research settings were the District headquarter Hospital Chiniot, Anmol, and Chiniot General Hospital, Faisalabad. Thirty-two patients with knee osteoarthritis aged 40-60 years were equally divided into two groups. Treatment applied for 4 weeks consisting of three sessions a week. The intervention group received balance exercise and conventional therapy, while the control group received only conventional therapy, including stretching and strengthening exercises. Outcome measures such as Knee Injury and Osteoarthritis Outcome Score (KOOS) and Berg Balance Scale (BBS) were filled out before and after treatment. An independent t-test was applied to compare the intergroup. After 4 weeks of treatment, no statistical difference was found between the two groups regarding knee function (P>0.05). However, the intervention group showed more improvement in the balance of patients than the control group (P›0.013). Balance exercises were proven to reduce fall risk and improve balance in knee osteoarthritis patients, but these exercises do not significantly affect knee function in comparison to routine physical therapy exercises.

Introduction: The most common joint disease in the world is osteoarthritis, which can lead to disability, mainly in the old population[1]. It is most common in females as compared to males. The prevalence of osteoarthritis is 10 to 15% at the age of 35 years and 36-45% at the age of 65 years [2]. 50% osteoarthritis is present in population more than 65 years of age [3]. Symptoms of arthritis are commonly muscular weakness, pain, decreased functional status, and impaired balance, which can be associated with the risk of falls [4]. Causes of this disease include severe pain, decreased movements, disability, and reduced functional activities [5]. Osteoarthritis is primarily present in weight-bearing joints, including the ankle, knee, and hip [6].

Many functional activities are compromised through osteoarthritis, like getting up from a chair, climbing stairs, walking, standing, and sitting. Financially, OA is a burden for patients. Continuous changes and destruction of the joint are shown due to knee OA. Pain is a primary pathological symptom in knee OA, which may progress towards decreased strength muscle [7]. There is less adaptation in gait pattern in the early stage of knee OA than in the later stage. During sit-to-stand tasks, people show asymmetrical weight distribution in the early stage of knee OA [8].

Knee instability is defined as the inability of the knee joint to control motion and maintain position through external loads. It is also defined as a shifting, buckling, and giving way of the knee joint during daily activities and is associated with limited activity [9]. Muscular weakness is responsible for activity limitation with impaired proprioception. High loading of articular cartilage can cause surface deformation, reduce cartilage tension, and increase contact areas of the joint [10]. Prevalence of knee pain is common in elite sports, Athletes, and military training. In younger adults, osteoarthritis is common due to obesity [11]. Increasing physical activity can decrease the chances of obesity, diabetes, and heart disease but can lead to knee injury due to high physical activity [12].

Osteoarthritis is the most common type of arthritis worldwide among older people. Knee arthritis is mostly occurring as compared to hip. Increased fall risk due to balance and gait disorder is secondary to osteoarthritis [13]. Loss of proprioception also occurs in people due to osteoarthritis [14]. Postural instability and increased risk of fall due to loss of proprioception. During movement-related tasks like walking and static activities, falls and loss of balance occur [15]. Neuromuscular changes are more impaired in patients with knee osteoarthritis, which can lead to a greater risk of falling, especially during balance activity [16]. Balance problems and the risk of falls are significant issues in patients with knee osteoarthritis.

Methodology: Quantitative Randomized Clinical Trial (RCT) was conducted using purposive sampling. Data was collected after obtaining permission from the institutional review board. The total duration of the study was four months, from January 2019 to April 2019. A signed consent form was obtained from the participants before their inclusion in the study. A sample of 32 was calculated using G*power, and then patients with knee osteoarthritis were selected from three hospitals: District Headquarters Hospital Chiniot, Anmol, and Chiniot General Hospital Faisalabad. These 32 participants were randomly allocated into treatment and control groups using an online randomization generator. Both male and female, participants aged between 40 and 60, with a BMI of 20 to 28, a history of falls (Berg Balance Scale less than 45 scores), and Patients with grade three and four knee osteoarthritis (Kellgren Lawrence scale). Bilateral knee OA with grades three and four (Kellgren Lawrence criteria) followed these criteria and was included in this study. Participants who received Physiotherapy intervention in their knees during the last six months, Knee joint surgery in previous three months ago, Neurological diseases such as stroke, Intra-articular injection in the previous six months, Loss of coordination, and visual impairment were excluded from the study. Two main outcome measure tools, i.e., the Berg Balance Scale (BBS), a valid and reliable tool with MCID between 4.55 to 6.7[17] for risk of fall and knee injury Osteoarthritis Outcome Score (KOOS scale), a valid and reliable tool with 14 points MCID[18] for osteoarthritis knee function, were used.

The interventional group (N=16) received routine physical therapy exercises and balance exercises.

For the Balance Exercise, the subject was asked to stand on one leg while he was standing near a supportive level or table, and the other leg stood up and kneeled down. Every time that subject could not keep his balance, he stood on his two legs for a few seconds, then he stood on the other leg, and this exercise was repeated in this way. It was performed for two minutes. Stepping forward and backward initially 20 and then progress to a maximum of 30 repetitions by using left leg and mini squat two-sided with 10 repetitions. Stepping forward and backward initially, 20, and then progressing to a maximum of 30 repetitions using the right leg and mini squat two-sided with 10 repetitions. Left-sided stepping with 30 repetitions with mini squat two-sided with 10 repetitions [19].

Routine physical therapy includes stretching and strengthening exercises of (hamstrings, quadriceps, and calf muscles). Command the patient to perform it daily and hold for a minimum of 15 seconds ten times in three sets. For strengthening exercises, command the patient to perform it daily ten times in three sets. Give intervals for three minutes during the strengthening exercise [20].

The control group received routine physical therapy for four weeks. Each group received three sessions per week for four weeks. Outcomes were recorded before treatment and then after treatment for four weeks. Each session lasted 20 minutes.19 Statistical Analysis was performed through SPSS version 20. Comparison of all study variables parameters between treatment and

control group was made by use of independent t-test Significance level (α) for all tests was set at 0.05.

Results: The results of independent samples t-test showed that treatment group had a higher mean value (32.36±11.76) than that of the control group (29.34± 13.70) at the end of four weeks (P›0.509). Both groups showed no more difference between their mean values (30.38±12.149) and control group (32.29±11.01) at the end of 4 weeks (P›0.645). KOOS scale indicates that there was no statistically significant difference in knee function between the intervention and control group at the end of the last treatment session (Table 1). The above table shows the values of BBS of both the treatment and control groups using independent samples t-test.

The treatment group showed higher mean values (52.12±4.31) than the control group (46.56±7.22) at the end of the 4th week. (P=0.013). The intervention group improved the balance of patients more than the control group (p=0.001). It showed that there was a positive effect of balance exercise on fall risk at the end of the month Table 2.

Discussion: This study stated that balance exercise along with routine physical therapy and routine physical therapy both improve patients' knee function in knee osteoarthritis. However, balance exercise along with routine physical therapy improves more balance than routine physical therapy alone.

Nejati et al., 2015, indicated that exercise was beneficial for decreasing pain and improving functional activities. Significant differences were found only in ADLS, sports activities, and pain of the KOOS questionnaire between the exercise therapy group and the non-exercise therapy group.21 This current study also exhibited that exercise improves ADLS and decreases pain in osteoarthritic patients.

Bruce et al., 2012, found that an exercise program is an effective treatment to reduce pain and disability and improve functions in knee osteoarthritis, significantly strengthening the quadriceps femoris muscles 41 patients were randomized with the ages of 55 and 75 years. Patients were selected for 6 6-week program to receive resistance training, and the control group received care. Their findings differed from this research because they concluded that the lasting results of 6 weeks of strength training of the quadriceps muscle remained the same after 14 weeks of treatment.22 In the current study, a significant difference was found in the balance scale for fall risk after exercise to improve balance (P›0.013). Strengthening exercises of the hamstring and quadriceps give a positive response to reduce pain and improve symptoms in patients with knee OA.

Knoop et al., 2014, indicated that strengthening exercise was an effective treatment for muscle weakness, especially in knee instability. Therefore, strengthening exercises are also called knee stability exercises. In power-full muscles with knee instability, strengthening exercises would be effective.14 The current study indicated that strengthening exercises

used as routine physical therapy were effective in reducing muscle weakness.

Gondim et al., 2017 investigate the effect of therapeutic exercise on muscle strength, balance, and pain, especially in older women with knee OA. The intervention group received balance and strengthening exercises, while the control group received only lectures for 12 weeks with two sessions per week. After 12 weeks, they concluded that the interventional group showed better results than the control group.23 Current Study showed that balance exercise was beneficial in the treatment group as compared to the control group (P›0.013).

Goddard, et al., 2019, show the effect of exercise on balance with one-side knee osteoarthritis. Twenty patients received star excursion balance tests in all eight directions: anterior, posterior, lateral, anteromedial, posteromedial, anterolateral, posterolateral, and medial, on both lower limbs. Strengthening and stretching exercises of both knee flexors and extensors should be performed within 30 minutes. Exercise improves dynamic balance in unilateral knee osteoarthritis with affected and unaffected limbs.24 The Findings of this research also support the current study because this research also indicated that exercise improved function and balance in knee osteoarthritis.

Conclusion: In conclusion, this study highlights that while balance exercises effectively reduce fall risk and enhance balance in patients with knee osteoarthritis, they do not demonstrate a significant advantage over routine physical therapy exercises in improving knee function. These findings suggest that incorporating balance exercises into rehabilitation protocols can provide added benefits for fall prevention and postural control but may not be essential for enhancing knee-specific functional outcomes beyond standard physical therapy regimens. Further research is recommended to explore the long-term effects and potential synergies of integrating both interventions for comprehensive knee osteoarthritis management.

Limitations: This study had limitations, including the quasi-experimental design, small sample size, limited follow-up, lack of blinding, and data collection restricted to specific hospitals. These factors limit generalizability, long-term assessment, and the ability to establish causality. Future studies with larger, more diverse samples and robust designs are recommended. Recommendations. Further research is suggested with a large sample size so that generalization would be easy. Further research is advocated to check the long-term effects of interventions by proceeding with follow-up sessions.

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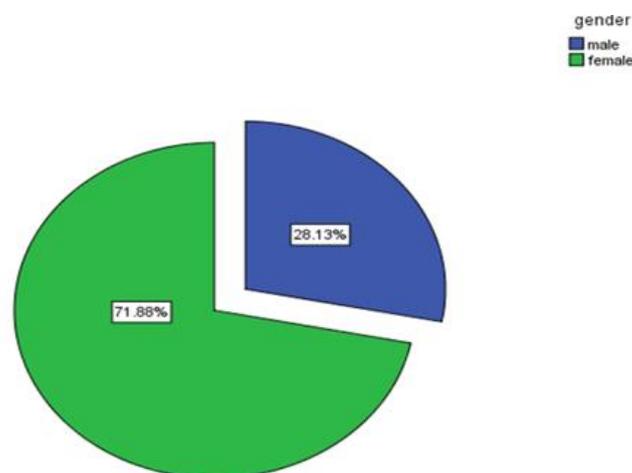
Fig 1.1 Gender distribution of sample

Table 1. Comparison of changes in KOOS Score variables

	Groups		N	Before treatment Mean±S.D	After treatment Mean±S.D	P value before treatment	P value after treatment
Symptom 1	Treatment		16	65.17±14.43	32.36±11.76	0.249	0.509
	Control		16	58.24±18.70	29.34± 13.70		
Pain 1	Treatment		16	64.06±14.67	30.38±12.14	0.627	0.645
	Control		16	61.45±15.31	32.29±11.01		
ADLS1	Treatment		16	61.13±9.17	29.56±7.99	0.116	0.988
	Control		16	54.50±13.55	29.50±12.80		
Sports and recreational activities	Treatment		16	71.56±15.88	40.62±11.08	0.115	0.897
	Control		16	62.81±14.60	40.00±15.7		

Table 2. Comparison of changes on the Berg Balance Scale

	Group	N	Before treatment Mean±S.D	After treatment Mean±S.D	P value before treatment	P value after treatment
BBS	Treatment	16	38.50±5.59	52.12±4.31	0.004	0.013
	Control	16	46.06±7.75	46.56±7.22		