



EFFECTIVENESS OF ADDING HIP ABDUCTOR STRENGTHENING EXERCISES TO THE CONVENTIONAL REHABILITATION PROTOCOL FOR POST TOTAL KNEE REPLACEMENT PATIENTS

Benazir Fathima A and Mercy Clara S

Madha College of Physiotherapy

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ABSTRACT

Background: Targeted Hip Abductor strengthening programs in patients with end stage knee osteoarthritis lead to improvement in symptoms and quality of life. Often ignored in post operative rehabilitation programs, there is sufficient evidence that the hip abductor weakness present prior to surgery continues after TKR and is not improved with current rehabilitation interventions.

Objectives: The purpose of this study is to find out the effectiveness of adding hip abductor strengthening exercises to conventional protocol for post TKR patients in sub-acute phase.

Methodology: Experimental study design with thirty patients, sixteen female and fourteen male patients with age group between 50-70 years who had undergone TKR and the study was conducted in three Hospitals in Chennai.

Outcome Measurement: The Physical function was measured by WOMAC and the Quality of Life is measured by SF-36 questionnaire. RESULTS: The WOMAC Score and health status measurement SF-36 Scores shows significant improvement in post TKR patients by including hipabductor strengthening program with conventional knee rehab protocol.

Limitations: Study conducted in small group size with short duration.

Conclusion: It is concluded that hip abductor strengthening exercises along with conventional knee rehab protocol found to have great effects for post TKR patients in functional outcomes and quality of life

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INTRODUCTION

Total knee replacement (TKR) has become the most renowned and successful surgery for patients with intractable joint pain with impaired physical function followed by end stage osteoarthritis of knee joint. For the past few years, TKR surgeries performed in India has a rapid growth and it tend to increase more than expected rate in the future¹. Although TKA reduces pain and improves self reported function in patients with end stage OA, the recovery of strength and function to normal is rare. The common limitations of the patients are diminished walking speed, difficulty in ascending and descending stairs, pain and stiffness occasionally². Therefore, rehabilitative protocols should focus on activities that help patients to improve the activities of daily living.

Rehabilitation following total knee replacement focuses on recovery of knee range of motion, strength and to develop functional independence. And of course knee rehabilitation continues to pose a challenge for both patients and providers³.

*Corresponding author: **Benazir Fathima A**
Madha College of Physiotherapy

The protocols that we are using currently includes cold therapy and compression, neuromuscular electrical stimulation, exercise therapy, balance training, continuous passive motion⁴. In spite of all these efforts this major surgery may go for a failure. The main reasons for knee implant failure are wear and loosening due to friction caused by joint surfaces rubbing against each other, infection, fracture, instability as the muscles and ligaments which surrounds the knee is too weak to support standing and walking, stiffness results in loss of range of motion leads to functional deficit. One such failure is due to lower extremity muscle weakness. The weakness of quadriceps muscle has received good amount of research attention and several studies had tested its contribution to functional limitations after TKR⁵. The lack of strength of other lower extremity muscles also contribute to functional limitations of these patients.

Hip Abductors and external rotators contribute to lower extremity function in patients who underwent TKA. These muscles stabilize the trunk and hip during gait, transfer forces from lower extremities to pelvis and also influence in knee loading⁶. Recent studies have proven that proximal muscle

weakness could possibly lead to altered physical function. Weakness of hip abductors result in contralateral pelvic drop, in turn shifts the center of mass with increased load medially to medial tibiofemoral joint⁷. To our knowledge, the investigations of strengthening exercises targeting the hip abductors to improve functional outcome for TKA patients has not been performed⁸.

The results of this study gives the answer about the role of hip abductors in functional ability and performance for the patients who had undergone TKR. And the purpose of our study is to examine the influence of an eight week strengthening program which includes hip abductors strengthening with knee strengthening program would improve functional outcome and physical function with TKR patients and to compare the functional outcome of TKR patients with knee strengthening exercises alone.

Aim of the Study: The aim of this study is to compare the effects of including hip abductor strengthening program in conventional protocol for TKR rehabilitation on functional performance measures and quality of life.

Need of the Study: Several studies were conducted regarding rehabilitation of TKR which includes or concentrate only on knee joint range of motion and strengthening exercises, in spite hip musculature play a vital role in knee bio mechanics and functional outcome measures. The need of this study is to achieve the better response, to improve the quality of life and the necessity to improve the standard of TKR rehabilitation protocol.

Objective of The Study: To find out the effectiveness of adding hip abductor strengthening to the conventional protocol for Total Knee Replacement . To compare the results of effectiveness of conventional protocol to the hip abductor strengthening protocol.

DESIGN AND METHODOLOGY

It is an Experimental study design by Convenient random sampling technique with thirty (30) post TKR Patients were selected and the duration of study is Eight weeks done at Three different Hospitals in chennai are Madha Medical College and Hospital, Madha Nagar, Kundrathur, Sree Balaji Medical college and Hospital, Chromepet and Dhanish Physiotherapy Center, Selaiyur, Chennai.

Inclusion Criteria: Age Group between 50 -70 years Male and Female were selected two weeks post Total Knee Replacement Ambulatory before Surgery.

Exclusion Criteria: Age group above 70 years, History of trauma or major surgeries, TKR Revision Associated conditions impeding the ambulation, Neuromuscular and neurodegenerative diseases Knee infection Uncontrolled diabetes.

Outcome Measures: SF 36 and WOMAC Osteoarthritis index are used.

Procedure: Thirty patients who fulfilled the above criteria were randomly divided into two groups of 15 subjects each. These Subjects were clearly explained about the techniques and procedures via demonstration and informed consent was signed. Pre test was evaluated for SF 36 and WOMAC Osteoarthritis Index and recorded by second week. Group A

(Control group): Patients treated with conventional knee protocol for TKR as mentioned in appendix I

Quadriceps Isometrics Active Knee Flexion



Gait Training Strengthening Exercise



Group B (Experimental group): Patients treated by including Hip Abductor strengthening in conventional knee protocol. Post test was recorded for both the groups by eight weeks post surgery. The exercises are given on daily basis till discharge from the hospital and three days in a week till 8 weeks post TKR. The Hip abductor exercises are included from second week and continued till eighth week for Group B.

Data Analysis

The present chapter deals with the important aspect of investigating data collected on WOMAC Osteoarthritis Index

and SF-36 questionnaire of 30 sample subjects to answer the research questions through suitable statistical techniques. The data on WOMAC Osteoarthritis Index and SF- Questionnaire were carefully assessed and recorded in full accuracy. The data's were subjected to suitable statistical techniques such as descriptive and inferential especially paired t test and unpaired t test.

STATISTICAL METHOD

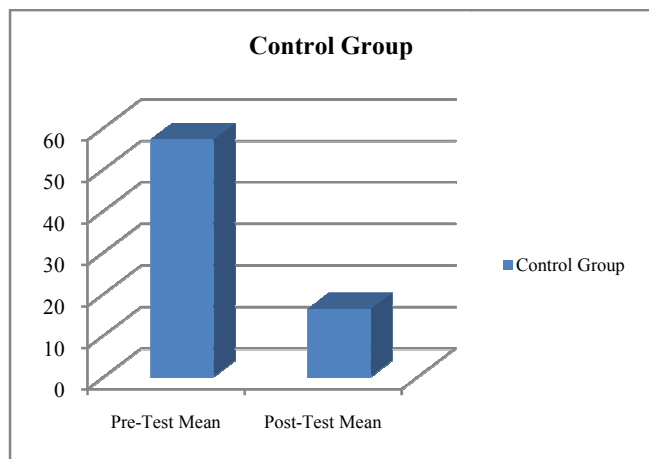
The following statistical tools were employed to analyse the data and testing of hypothesis. Data analysis was done by using SPSS software version (16.0).

The scores were obtained by using WOMAC and SF -36 questionnaire. All the dependent variables within group B were analyzed using paired 't' test. All the dependent variables between the groups A and B was analysed using independent 't' test. Statistical significance was set (p<0.05>level.

Table 4.1 Comparison of Pre-Test and Post-Test for Control Group – A for WOMAC

Group	Pre-Test		Post-Test		T Test	P value
	Mean	SD	Mean	SD		
Control	57.2	8.97	16.4	3.04	23.22	0.00

The mean value of pre test for control group in WOMAC is 57.2 and mean value of post test for control group in WOMAC is 16.4. Paired t test shows P<0.01 hence it is statistically significant.

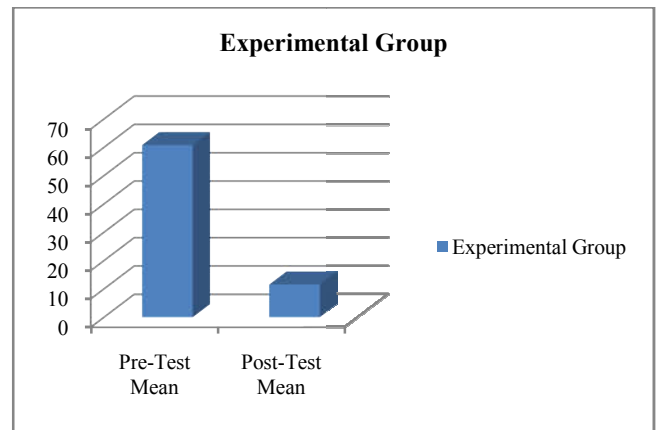


Comparison of Pre-Test and Post-Test for Control Group – A for WOMAC.

Table 4.2 Comparison of Pre-Test and Post-Test for Experimental Group – B for WOMAC

Group	Pre-Test		Post-Test		T Test	P value
	Mean	SD	Mean	SD		
Experimental	60.87	7.78	11.6	2.13	32.16	0.00

The mean value of pre test for experimental group in WOMAC is 60.87 and mean value of post test for experimental group in WOMAC is 11.6. Paired t test shows P<0.01 is statistically significant.

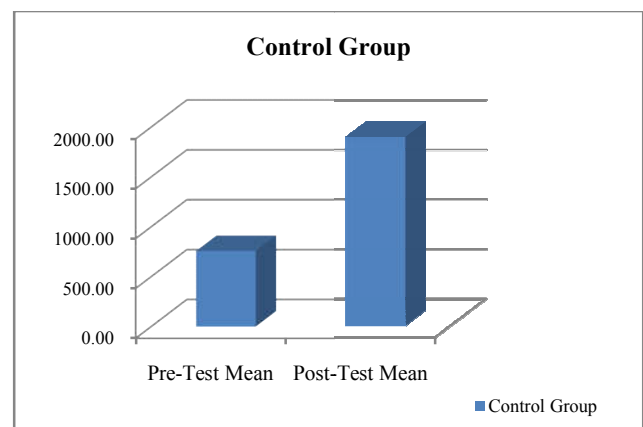


Comparison of Pre-Test and Post-Test for Experimental Group – B for WOMAC

Table 4.3 Comparison of Pre-Test and Post-Test for Control Group –A for SF 36

Group	Pre-Test		Post-Test		T Test	P value
	Mean	SD	Mean	SD		
Control	759.33	178.43	1900.00	283.92	21.74	0.00

The mean value of pre test for control group in SF -36 questionnaire is 759.33 and mean value of post test for control group in SF -36 questionnaire is 1900. Paired t test shows P<0.01 hence it is statistically significant.

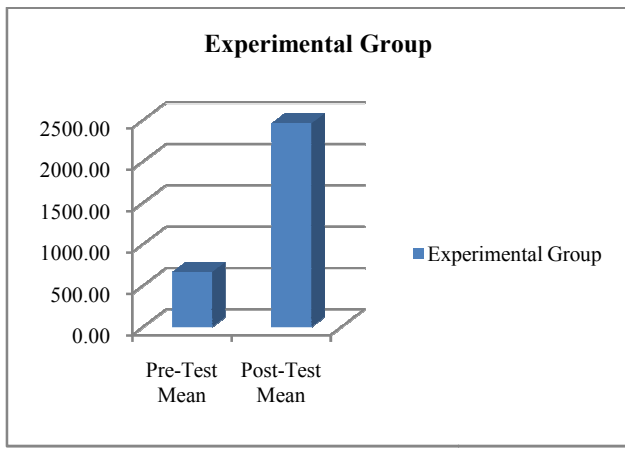


Comparison of Pre-Test and Post-Test for Control Group–A for SF 36

Table 4.4 Comparison of Pre-Test and Post-Test for Experimental Group–B for SF36

Group	Pre-Test		Post-Test		T Test	P value
	Mean	SD	Mean	SD		
Experimental	665.33	120.87	2461.0	378.50	21.75	0.00

The mean value of pre test for experimental group in SF -36 questionnaire is 665.33 and mean value of post test for experimental group in SF -36 questionnaire is 2461.0. Paired t test shows P<0.01 hence it is statistically significant.

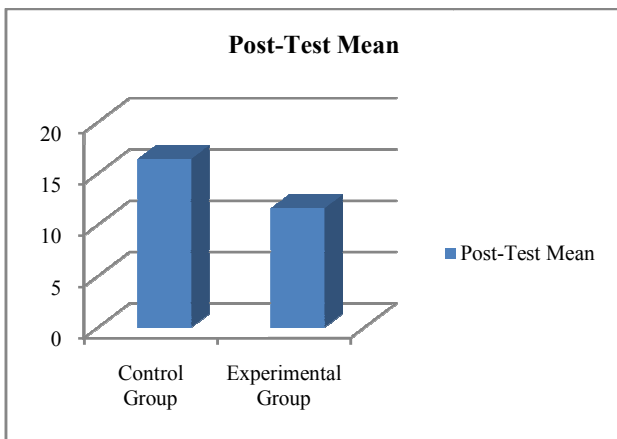


Comparison of Pre-Test and Post-Test for Experimental Group-B for SF36

Table 4.5 Comparison of Post-Test for Control and Experimental Groups-Womac

Group	Post-Test		T Test	P value
	Mean	SD		
Experimental	11.6	2.13	4.72	0.00
Control	16.4	3.04		

The mean value for post test for WOMAC score in control group is 16.4 and experimental group is 11.6 Paired t test shows $P < 0.01$ hence it is statistically significant

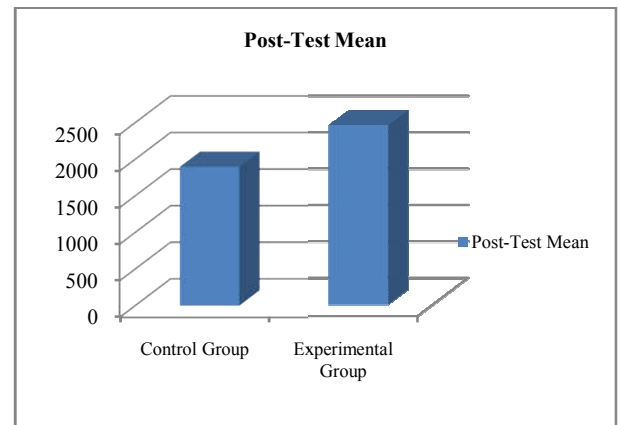


Comparison of Post-Test for Control and Experimental Groups-Womac

Table 4.6 Comparison of Post-Test for Control and Experimental Groups-SF 36

Group	POST-TEST		T Test	P value
	Mean	SD		
Experimental	2461	378.5	5.63	0.04
Control	1900	283.9		

The post test mean of control group is 1900 and experimental group is 2461. Paired t test shows $P < 0.01$ hence it is significant at 1% level



Comparison of Post-Test for Control and Experimental Groups-SF 36

RESULTS

The statistical analysis showed that the mean total of WOMAC score and SF-36 questionnaire of Group A and Group B showed differences in pre and post test scores within groups.

- Group A WOMAC (pre test-57.2, post test - 16.4), SF-36 questionnaire (pre test - 759.33, post test - 1900.00)
- Group B WOMAC (pre test- 60.87 , post test - 11.6), SF- 36 questionnaire (pre test- 665.33, post test - 2461.0)
- Mean value of pre test and post test scores of Group A and Group B shows significant differences in improvement.
- SD value also shows significant difference between pre and post test scores of Group A and Group B.
- Group A WOMAC (pre test- 8.97, post test - 3.04), SF-36 questionnaire (pre test - 178.43 , post test- 283.92)
- Group B WOMAC (pre test - 7.78, post test -2.13), SF-36 questionnaire (pre test-120.87, post test -378.50)

DISCUSSION

In this experimental study after 8 weeks of treatment for two groups of fifteen patients, including hip abductor strengthening in conventional knee rehabilitation protocol for Total Knee Replacement patients and conventional protocol for post TKR patients in sub acute phase, we found that from the statistical analysis including hip abductor strengthening with conventional knee protocol has given positive results compared to the application of conventional knee rehabilitation protocol alone.

A report by Pozzi *et al* reviewed and highlighted the benefits of supervised physiotherapy sessions that progress in intensity based on the patient's progress. The strengths of his review lie in their inclusion of several rehabilitative modalities such as strengthening, aquatic therapy, balance training, and the importance of clinical environment³⁰. In another review, Westby *et al* examined the available literature for therapy after TKR and outlined the advantages of structured, supervised rehabilitation. The optimal rehabilitation protocol should include several components³¹. The conventional protocol engages the patients in strengthening and functional exercises of knee joint only. Careful early mobilization of the patella in all directions is critical for optimal ROM³². Rehabilitation is encouraged to begin as soon as the first POD. Strengthening

programs can begin as closed-chain quadriceps exercises with supplemental weight added^{33 34}, and eventually progress to include eccentric and is kinetic exercises that are performed in concentric and eccentric modes throughout the entire knee ROM^{35 36}. Goals included an emphasis on improvement of functional independence and mobility, normalization of gait mechanics, pain reduction, and attainment early ROM³⁶. The research by Ebert *et al* that suggests active knee flexion of 80 degrees at the initial outpatient visit (1–2 weeks post-TKA) is strongly correlated with active knee flexion of 110 degrees at 7 to 8 weeks after TKA. The achievement of 110 degrees of knee flexion has been shown to provide a satisfactory function for most patients to complete most activities of daily living³⁷. Balance training may also be supplemented into therapy sessions in an effort to restore joint proprioception and postural control. Rehabilitation is of the utmost importance following total joint replacement in order to ensure pain-free function of the joint and improve the patient's quality of life (QOL)³⁸.

The conventional TKR protocol also improves the strength of knee muscles and improves the ROM of knee joint²⁰. Strengthening the quadriceps muscle is one of the intrinsic factor that shows it affects the knee joint. It is evident that the lower extremity strength has a major role in knee joint shock attenuation during weight bearing activities. The isometric quadriceps exercises brought significant gain in strength of quadriceps muscle helps in weight bearing activities³⁹. The isometric quadriceps exercise showed beneficial effect on quadriceps muscle strength, pain and functional ability. The WOMAC score and SF – 36 scores also shows significant improvement in Group A as there is improvement in functional outcome and quality of life. There has been a small quantity of research with promising findings that adding hip strengthening programs in conventional protocol may lead to improvement in symptoms and quality of life⁴⁰. As noted in some studies, strength of the hip muscles, especially the hip abductor, may be altered in knee OA patients⁴¹. A research finds that the isokinetic strength of hip abductor in Knee OA group is remarkably lower than that in control group. Similarly, it is also found that the hip abductor in knee OA patients is reduced by 24% compared with that in normal controls. Not only the isokinetic strength, but also the isometric strength of hip abductor in Knee OA patients are smaller than normal⁴². Typically, the hip abductor plays an important role in stabilizing the trunk and pelvis in gait cycle⁴³. Therefore, weakness of hip muscle may lead to changes in the position of body center, resulting in contra lateral movement of the pelvis or lateral leaning of the trunk over the standing limb. This would thus increase the magnitude of knee adduction moment, which is an indicator of disease progression⁴⁴. Consequently, it seems that hip abductor appears to have certain impact on knee joint load, which may also play a potential role in the symptoms and progression of disease.

Patients in Group B shows marked improvement than Group A in functional outcome and Quality of life which is attributed exclusively by adding hip abductor strengthening exercises to the Conventional knee rehabilitation protocol followed for Total Knee Replacement. Although often ignored in post-operative rehabilitation programs, there is sufficient evidence that the hip abductor weakness present prior to surgery

continues after TKA and is not improved with current rehabilitation interventions^{45 46}. Post-operative pain, reduced demands on the operated limb in the early post-operative period and habitual gait patterns are also likely to contribute to further reductions in hip abductor strength⁴⁷.

Following TKA, there is a correlation between hip abductor strength and functional outcomes. Hip abductor strength contributes to physical function such as turning whilst walking and rising from a chair in people with unilateral TKA. Rehabilitation programs specifically include hip abductor strengthening exercises, it is unlikely that the hip abductors will return to normal levels of strength, contributing to ongoing difficulties in activities of daily living such as walking and stair climbing⁴⁸. Given the improvement in strength seen in pre-operative patients, it is likely that similar rehabilitation efforts will yield improvements in function post-operatively. Despite this, no study has investigated the effects of hip abductor strengthening on improving strength or function following TKR as stated by Schache *et al*.⁴⁹

In Group B Patients with efficient lower limb strength following TKR perform better on functional activities demonstrating that lower limb strength contributes to functional performance. The role of hip abductor strength in TKR patients have showed significant contributions in functional independence. This is not surprising as the hip strength and hip joint mechanics have a close relationship to normal knee function. Achieving optimal outcomes following TKR therefore would require optimal hip strength in combination with optimal quadriceps strength. The lower extremities have formed a whole kinematic chain, which makes it impossible for the hip, knee or ankle joints to work completely independent from each other.

This study made to specifically assess the effect of hip abductor strengthening exercises in post TKR patients during sub acute phase. This is particularly relevant as the number of patients undergoing TKR is rapidly increasing worldwide. Many studies striving to achieve better outcomes for TKR patients continue to focus on impairments associated directly with the knee joint. Recovery has been variable and the majority of patients continue to demonstrate lower extremity muscle weakness and functional deficits such as slower walking speeds, difficulty negotiating stairs and difficulty rising from a chair when compared to age matched healthy individuals⁵⁰. Therefore, it is reasonable to hypothesize that the causes of disability and poor function following TKR may also be related to other joints, particularly the hip. This hypothesis is further strengthened by the presence of hip abductor muscle weakness in patients with knee OA which persists post TKR. It is important to evaluate the effectiveness of rehabilitation programs with appropriate outcome measures. This study has ensured that outcome measures are included from the three different domains such as pain, function and quality of life. The outcomes measures used in this study are WOMAC and SF-36 questionnaire are highly reliable and valid^{51 52}. The outcome measures WOMAC and SF-36 shows significant improvement in Group B when compared to Group A.

CONCLUSION

From the results of this study it is concluded that hip abductor strengthening exercises along with conventional knee

rehabilitation protocol found to have greater effects for post TKR patients in functional outcomes and quality of life than conventional knee rehabilitation protocol alone. The hip abductors are well renowned for the stabilization of trunk and hip during walking, maintaining the femoropelvic alignment and transferring the forces from the lower limbs to the pelvis. Including Hip abductor strengthening exercises is a key component in rehabilitation following TKR for optimal functional performance.

Limitations of the Study is that it is conducted in short duration with small sample size and Protocol includes only strengthening of hip abductors.

Recommendations are the Study can be conducted for long duration of time with larger sample size and Protocol can include other hip joint muscles and also for distal joints.

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