

# Mid Term Outcome of Home-Based Exercises vs. Sophisticated Physiotherapy Protocol After Total Knee Arthroplasty

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## Abstract

**Background:** As the population is getting older, the recent increasing rate of total knee replacement has raised some doubts over its potential outcomes. Physical therapy or home-based exercise has been regarded as the prerequisites for excellent outcomes after primary total knee arthroplasty. However, comparison of physiotherapy exercise with home exercise program after primary TKA has not been addressed.

**Methods:** The present study compared the impacts of physiotherapy protocol with those of home-base exercise after TKA. In this regard, a post-operative clinical evaluation was conducted on 2,250-member groups of patients. The mean ages of physiotherapy and home-based exercises groups were  $65 \pm 1$  and  $61 \pm 6$ , respectively.

**Results:** The clinical and statistical analyses indicated the effective improvements in functional results and quality of life parameters. All OKS, WOMAC, and KOOS approximately assessed the same improvement in both group. The 6-minutes walk distance improved about 12% in both groups. Baseline measurements through 4 years of follow-up revealed considerable and equal improvements in both groups.

**Conclusions:** It was concluded that there were no significant differences between the 2 groups. After primary total knee arthroplasty, the improvement of patients following a home exercise program was similar to improvement of the patient completing a regular physical therapy. However, further researches are required.

**Keywords:** Primary Total Knee Arthroplasty, Physical Therapy, Home-Based Exercise

## 1. Background

Latest global statistics declares that 110 million people are suffering from osteoarthritis, which is one of the main causes of total knee arthroplasty (TKA) (1, 2). The number of primary total knee arthroplasty has boosted significantly in recent years and amounted to 1.5 million in 2015 (3).

The routine of TKA procedure involves a physiotherapy protocol after the patients' discharge from the hospital with a planned follow-up of the surgeon for 3 months (3, 4). For quick regain of functional abilities, patients and surgeons most often employ physiotherapy methods. Based on the recent studies, only physical therapy programs are only provided for 26% of patients following their discharge from the hospital (4-7).

Physiotherapist-supervised physiotherapy treatments or home exercises are among the rehabilitation and recovery programs, which can play a crucial role in restoring functional abilities among the patients undergone TKA. In this regard, physiotherapy treatments 2 or 3 times a week has been considered as a common routine (5, 6). The requirements of physiotherapy and rehabilitation for en-

hancing their effectiveness have increased the healthcare costs in a way that numerous researches have been concentrated on some home exercises (5). Clinic-based programs are mainly presented by outpatient physical therapy clinics, facilitating monitoring the progress of the patient, individual program modification, and patient support as well as motivation. In home-based programs, the patient does not have to participate in outpatient clinic sessions or the number of his/her attendance is minimum; however the monitoring and modifications chances would also be minimum (7-10).

Lowes's (11) review article investigated 6 randomized trial researches regarding the effectiveness physiotherapy on 614 patients who had a complete knee replacement following their discharge from the hospital. The efficacy of clinic and home-based rehabilitation programs for elderly patients is of crucial importance. Surgeons may hesitate in prescription of nonclinical-based rehabilitation programs for this group of patients, regarding the probability of complicating medical conditions, serious postoperative complications, and the medicolegal climate. The manda-

tory outpatient physiotherapy sessions are often substituted with completing a limited number of clinic visits. Home-based programs can replace physical therapy as well (12-14).

Research studies on exercise-based rehabilitation following hospital discharge indicated that several patients chose or sought for physiotherapy exercises other than what were presented in their allocated group. Providing physiotherapy treatments at home can be considered as an accessible and affordable solution with a probably higher acceptability and uptake. Efficiency decrease in one of the serious concerns of home-based exercise rehabilitation; however, this approach is crucial for patients not attending physiotherapy sessions, as they are more likely to have poorer functional health. Uptake optimization and adherence to interventions are essential in rehabilitation procedures (7, 12-14).

This study is focused on comparing functional and clinical results of a home-based exercise with those of physical therapy program after primary TKA.

## 2. Methods

This study was conducted on 500 patients who underwent TKA from January 2008 to August 2011. The patients were divided into 2 groups, 1 group received supervised physiotherapy treatments (physiotherapy group) while the other was treated by a home-based exercise (home exercise group). 250 patients of physiotherapy group were randomly assigned to a clinical treatment after TKA (54% female, 46% male; mean age  $65 \pm 1$  years). Whereas the 250 members of home exercise group (68% female, 32% male; mean age  $61 \pm 6$  years) received a home exercise program for 8 weeks. After 4 years of follow-up, all the patients were assessed in terms of their quality of life regarding the Knee injury and osteoarthritis outcome score (KOOS) form, Oxford knee score (OKS), and The Western Ontario and McMaster Universities osteoarthritis index (WOMAC). Post-discharge follow-up interventions of TKA patients were mainly connected on the effect of various programs for physiotherapy.

Home-based exercises were evaluated as effective as outpatient physiotherapy programs with respect to physical function and health-related quality of life. Patients suffering from rheumatoid arthritis or major neurologic conditions were excluded.

Within 5 weeks after discharge, exercises of home exercise group were controlled once a week. If needed, the physiotherapist readjusted their program. Daily 1-hour home exercises were carried out by members of this group. The home exercise program involved knee joint motion limit arrangement and retaining knee and hip muscle

strength. The physiotherapy program lasted for 5 weeks and was carried out 5 days a week. Knee joint range of motion (ROM) exercises and knee and hip reinforcing exercises were the main components of this program. These exercises were implemented after moist heat application for 30 minutes and 20 minutes of conventional transcutaneous electrical nerve stimulation (TENS).

The objective of these programs (home-base and physiotherapy protocol) are to decrease the pain, enhance the range of motion and the overall functional strength, posture and gait cycle education, as well as physical fitness levels and mobility improvements. At the end of 15th week, patients were allowed to follow their previously-described clinic-based rehabilitation. Based on the advice of their surgeon, physiotherapy, and exercise are widely promoted after TKA.

This clinical study was conducted in a hospital of Shahid Beheshti University of Medical Sciences (SBUMS) from 2008 to 2011 and approved by its hospital. The authors are responsible for that though. All these operations were closely supervised by the authors. All the participants were aware that data will be submitted for publication and they all give their consent.

## 3. Results

The mean age of the patients was  $61.1 \pm 6$  and  $65.08 \pm 1$  in a home-based exercise and the physical therapy groups, respectively. Other descriptive data are listed in Table 1. The statistical package for the social sciences (SPSS) version 16.0 was employed for further statistical analysis. Descriptive statistical data are expressed as means  $\pm$  standard deviation ( $x \pm SD$ ) or percentage (%).

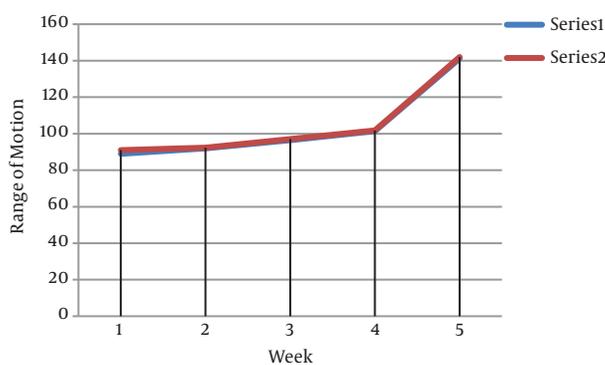
The data were recorded in a spreadsheet (Microsoft Excel for Mac 2011, version 14.2.3). Groups were compared after implementation of descriptive analysis of the variables (means and standard deviations). Next, pre- and post-intervention scores were compared in the groups by t-tests, (as an appropriate tool for mean comparison between the 2 groups). Scores of all outcomes were performed through application of t-tests with confidence interval of 95% ( $P = 0.05$ ).

Evaluation of ROM was carried out by a digital goniometer. Active ROM was employed for comparing the groups. Series 1 and 2 represent post-operative ROM of home-based exercise and sophisticated physiotherapy groups, respectively. ROM data can be found in Figure 1.

The 2 groups showed no statistically significant difference in terms of activity pain after 4 years. Comparison of ROM with functional status of the patients also exhibited no statistically significant difference at each assessment point.

**Table 1.** Demographic Characteristics of the Patients

Variables	Sophisticated Physiotherapy Group		Home-Based Exercise Group	
	Min - Max	X ± SD	Min - Max	X ± SD
Age, y	62 - 69	65.2 ± 1.3	60 - 77	61.8 ± 6.4
Height, cm	149 - 162	153.75 ± 1.54	152 - 166	160.17 ± 3.16
Weight, kg	56 - 114	88.75 ± 27.11	49 - 123	84.13 ± 14.52
BMI, kg/m <sup>2</sup>	24.44 - 45.65	35.34 ± 7.37	20.13 - 44.12	29.92 ± 6.27

**Figure 1.** Post-Op ROM of Home-Based Exercise and Sophisticated Physiotherapy Groups

Series 1, Home-based exercise group; Series 2, Sophisticated physiotherapy group.

Prior to surgery, the average of Oxford knee score (OKS) was  $21 \pm 1.70$  in all patients. After total knee arthroplasty this score was enhanced to  $43.81 \pm 1.31$  and  $42.76 \pm 1.96$  for patients in the physical therapy group and home-based exercise group, respectively. The Western Ontario and McMaster Universities Osteoarthritis index (WOMAC) can be used in assessment of functional status, pain, and stiffness. Patients in both groups showed a significant improvement in total WOMAC scores: by 58% and 49% in physical therapy and home-based exercise groups, respectively. Evaluation of overall life quality was performed by means of knee injury and osteoarthritis outcome score (KOOS). This parameter also demonstrated a significant improvement by about 50% in both groups. Moreover, both groups exhibited clinical postoperative improvements.

Comparison of the mentioned indices between the 2 groups is summarized in [Table 2](#).

A 6-minute walk test assesses the distance a patient walks within 6 minutes and could be used as a reliable method to evaluate the functional exercise capacity. This index showed about 12% improvement in both groups.

#### 4. Discussion

As a golden standard, the total knee arthroplasty can be used for decreasing the pain, correcting the deformities, and retaining the stability in patients at the terminal stages. According to the report of the majority of the patients, TKA will result in successful long-term outcomes and significant pain.

Several studies have compared the supervised physiotherapy and standardized home-base programs after anterior crucial ligament repair. However, the number of studies addressing TKA is very limited (15). There is a general consensus that completely-finished exercises programs can promote walking and independence in daily life activities after various surgeries including TKA. However comparative studies on the advantages of clinic-based and home-based rehabilitation programs in this population have not been fully addressed.

Moreover, there is no study determining the requirements of physiotherapy protocol for patients who underwent TKA in Iran. In this regard, this study is aimed to compare the functional outcomes of home program and supervised physiotherapy.

Physiotherapy and rehabilitation have been widely applied to help patients regain their functionality and independence and return to their normal lives. These processes play crucial roles in getting back on their feet and starting an active lifestyle. They can also accelerate healing from surgery and greatly enhance the chance for long-term success (16, 17). Today, elevations of healthcare costs and extensive competition in this sector have drawn the attention of economists and politicians in cost analysis as well as calculation of cost-effectiveness.

Clinical studies on home exercise have indicated that this approach can be as effective as supervised physiotherapy. Unfortunately, no study has compared the supervised physiotherapy with rehabilitation and standardized home exercises and analyzed the costs of post-TKA programs (4, 7, 18-21).

Patients who underwent TKA experience some difficulties along with being benefited from physiotherapy and

**Table 2.** Difference Between Sophisticated Physiotherapy Group and Home-Based Exercise Group

Scoring Systems	Pre-Op	Sophisticated Physiotherapy Group, 4 Years Follow-Up	Home-Based Exercise Group, 4 Years Follow-Up
OKS	21 ± 1.70	43.81 ± 1.31	42.76 ± 1.96
WOMAC Improvement, %	-	58	49
KOOS (QOL)	8 ± 0.9	12 ± 0.4	11 ± 0.27

rehabilitation outpatient clinic services. Crowded clinics and insufficient physical facilities may delay treatment and rehabilitation programs and therefore may discourage the patients and decrease their motivation. Regarding the economic burden of health care, instructing well-planned home exercise program to the patients along with regular physiotherapist follow-ups will be adequate. As a crucial component of TKA treatment, postoperative exercises are aimed to improve the patients' ability in practicing routine activities immediately after the surgery and also maximize the long-term functional gain of TKA (22-26).

It seems that the effects of physiotherapist-instructed rehabilitation exercises are similar whether performed unsupervised, at home, or under supervision of a physiotherapist in an outpatient clinic. Available literature have revealed no significant difference between physiotherapy-receiving patients and those treated with an at home exercise program in terms of knee joint ROM, patient's functional status, and overall health condition. This study made the mentioned comparisons through a minimum 4-year prospective follow-up.

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