



EFFECTS OF EARLY HIGH-INTENSITY REHABILITATION PROGRAM AND CONVENTIONAL PHYSICAL THERAPY TO IMPROVE RANGE OF MOTION AND FUNCTIONAL ACTIVITIES FOLLOWING TOTAL KNEE ARTHROPLASTY - A COMPARATIVE STUDY

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Abstract

Objectives: The aim of this study is to find out the effects of high-intensity exercises and conventional physical therapy to improve range of motion and functional activities in primary unilateral total knee arthroplasty.

Study Design: Quasi-Experimental study design, **Study Setting:** Department of physical therapy in - KMCH, COIMBATORE, **Methodology:** 20 Total Knee Arthroplasty subjects who met the inclusion criteria will be selected for the study and will be assigned into high intensity rehabilitation group and conventional group. Group A 10 members received High-Intensity exercises and Group B 10 members received Conventional physical therapy. Outcome measures are range of motion measurement using goniometer, time-up and-go test, and stair climbing test and knee outcome survey-activities of daily scale. **Results:** Paired't' test and Independent 't' test were done and it was found that there was a significant difference in both groups in improving range of motion and functional activities in total knee arthroplasty subjects. There is statistically significant difference found between the high-intensity group and conventional physical therapy group in improving range of motion and functional activities in unilateral total knee arthroplasty. **Conclusion:** Our findings suggested that mean values of both groups result shows that the high intensity exercises show better improvement than the conventional physical therapy in improving range of motion and functional activities in unilateral total knee arthroplasty.

Key words: Total knee arthroplasty, osteoarthritis, high-intensity rehabilitation program, range of motion, functional activities.

Introduction

Osteoarthritis is a progressive disorder of the joints caused by gradual loss of cartilage resulting in development of bony spurs and cysts at the margins of the joints. Symptoms are occasional pain, swelling and warmth in the knee joint. End-stage osteoarthritis leads to decreased range of motion, tenderness, crepitation, bone enlargement and deformity in the knee joint.⁹ Management of osteoarthritis in early stage are with pain-killers like Non-Steroidal Anti-inflammatory Drugs to relieve pain. Other interventions are exercises, cortisone shots and arthroscopic surgery to prevent the progression of disease and to give temporary relief. If the disease progresses to end-stage osteoarthritis patient is posted for total knee arthroplasty.¹⁴The Global burden of osteoarthritis in 2000 reports that females are suffering more with osteoarthritis than males. In world level Disability Adjusted Life Yearly (DALY) females are 8,667 /10,000 and males are 5,549/10,000 affected with osteoarthritis.⁶

Total Knee Arthroplasty is frequently implemented as a treatment for knee osteoarthritis when more conservative options have failed to relieve disabling symptoms. Total Knee Arthroplasty successfully



alleviates pain, but after surgery impairments in quadriceps strength, voluntary muscle activation and functional performance usually occurs.

Petterson et al., 2009 stated that in post total knee replacement surgery there is 60% reduction of quadriceps strength in 1 month at the same time functional performance also worsen by 20-25% in one month. These deficits in strength and function do not resolve spontaneously.³⁵

Michael J. Bade et al., 2011 compared 12th month post-operative total knee replacement patients with age-matched normal individuals which concluded that patient who have undergone total knee arthroplasty have 18% slower walking speed and 51% have slower stair climbing speed than normal individuals. At the same time 75% of total knee replacement patients feel difficulty in climbing stairs after a year of surgery.²³ Regular exercises are important to restore knee mobility, strength and functional activities. Hence this study was done to compare the effects of conventional physical therapy with the effects of a high-intensity rehabilitation program after Total knee Arthroplasty on improving the range of motion and the functional activity of those patients.

Materials and Methodology

It is a Quasi- Experimental study done in the physiotherapy department of KMCH, Coimbatore. We included female subjects between the age group of 50 to 75 years , primary unilateral total knee replacement clients having contralateral knee osteoarthritis (as defined by a verbal numerical pain rating of less than 4/10 while walking or climbing stairs) and cemented post total knee arthroplasty status. Subjects with uncontrolled hypertension, diabetes, females having body mass index greater than 35 kg/m², neurological impairments and those who underwent uncemented total knee replacement were excluded. 20 samples who satisfied the inclusion criteria were selected for the study. Out of this 10 subjects were allotted to conventional group and 10 subjects to high intensity exercise group. The outcome tools included Range of motion measure of knee joints, Timed-up and go test, Stair climbing test and Knee Outcome survey – Activities of Daily Living.

Treatment procedure consist of three phases:

Group-1 High-Intensity Exercises:

Phase 1 (Weeks 0-2)



Phase 2 (Weeks 2-4)

Phase 3 (Weeks 4-6)

Group: 2 Conventional Exercises:

<p>PHASE 1 Supine knee flexion (heel slides) Short-arc knee extensions, Clamshell exercise, Hip adduction and abduction in side lying, Ankle pump exercise.</p>	
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<p>PHASE 2 Seated single-leg knee extension, Straight leg raise, Standing hamstring curls, Side lying hip adduction and abduction with resistance, Standing bilateral calf raise, Repeated sit to stand training, Marching or single leg stance, Multi directional stepping</p>	
<p>PHASE 3 Seated single leg knee flexion and extension, Standing hip flexion, standing hip abduction, Standing hip extension, Step up, side step up and step down, Single leg stance progression, Agility exercises – braiding, Backward walking, Side shuffling, Forward lunges</p>	

Progression of exercises is done when-

Subjects were able to complete 2 × 8 reps without fatigue; Numerical pain rating at rest was less than 5/10 and Range of motion was increased by 15°- 90°.

Group: B Conventional Exercise

The total number of physical therapy sessions for this group after discharge was 16 visits over 6 weeks. Both weight-bearing and non-weight-bearing exercises were initiated with 2 sets of 10 repetitions, and then progressed to 3 sets of 10 repetitions. For strengthening exercises, weights were increased to maintain a 10-repetition maximum targeted intensity level; however, the maximum weight utilized for any strengthening exercise was a 4.5-kg ankle weight. Resistive exercises consisted of quadriceps setting exercise, seated knee extensions, straight leg raises, side lying hip abduction, and standing hamstring curls. Body weight exercises consisted of step-ups, side step-ups, step-downs, terminal knee extensions, single-limb stance, and wall slides.

Data Analysis and Result

The collected data were tabulated and analyzed using descriptive and inferential statistics. Median was used to assess all the parameters of the data using statistical package for social science (SPSS) version 18. From the given data, it passes the normality, so the t- test has done. Pair-wise comparison of High Intensity group (table. 1) showed that there was statistically significant difference in Range of Motion, Timed up and go test, Knee outcome survey and Stair climbing test between pre and post test within group which denotes that there was a significant improvement in Range of Motion, Timed up and go test, Knee outcome survey and Stair climbing test after High Intensity group Training in Total Knee Arthroplasty subjects (Graph 1). In the Conventional Physiotherapy (Table. 2) there was a statistically significant difference in in Range of Motion, Timed up and go test, Knee outcome survey and Stair climbing test between pre and post test within group B which denotes that there was a significant



improvement in Range of Motion, Timed up and go test, Knee outcome survey and Stair climbing test following the Conventional Physiotherapy in Total Knee Arthroplasty subjects (Graph 2). According to table 3 there was no significant difference between posttest values of , Timed up and go test, Knee outcome survey and Stair climbing test between the groups and significant difference between posttest value of Range of Motion which denotes that there is no significant difference between both groups in Timed up and go test, Knee outcome survey and Stair climbing test and significant difference between both groups in Range of Motion (graph 3).

Table 1: Comparison of pre and posttest values of Range of Motion, timed up and go test, knee outcome survey and Stair climbing test of Group A treated with High-Intensity Training

Outcome scales	Paired ‘t’ test		‘t’ value	Level of significance
	Pre-test	Post-test	Calculated ‘t’ value	
Range of Motion	49.50	108	29.55	0.000*
Time - Up and- Go test	8.805	2.513	14.81	0.004*
Knee Outcome Survey Activities of Daily Living Scale	0.9054	1.545	8.395	0.061*
Stair climbing test	45.919	26.057	22.875	0.004*

(*P ≤ 0.05), (**P > 0.05)

Graph 1

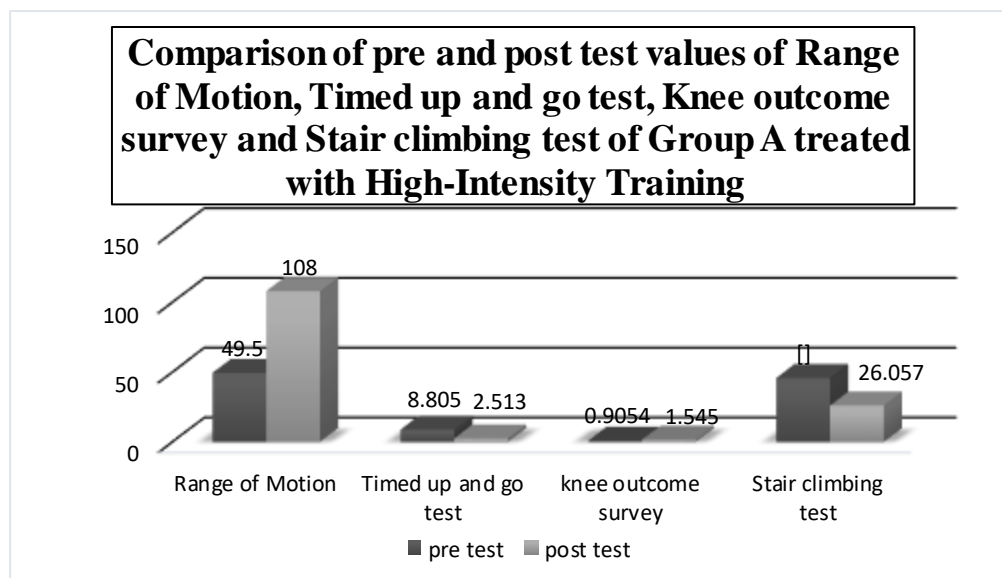




Table 2: Comparison of pre and post- test values of Range of Motion, Timed up and go test, Knee outcome survey and Stair climbing test of Group B treated with Conventional Physiotherapy

Outcome scales	Paired ‘t’ test		‘t’ value	Level of Significance
	Pre-test	Post-test		
Range of Motion	47.50	94	35.72	0.003*
Time - Up and-Go test	8.726	4.862	10.3779	0.041*
Knee Outcome Survey – Activities of Daily Living Scale	0.7906	1.466	8.399	0.050*
Stair climbing test	45.983	32.101	16.5629	0.004*

Graph 2

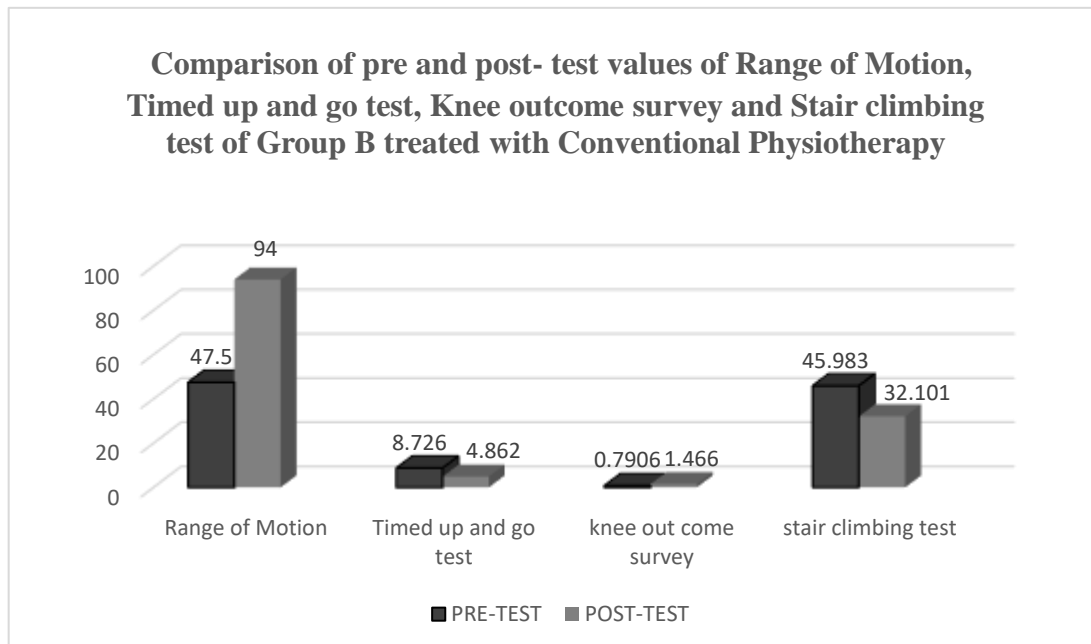
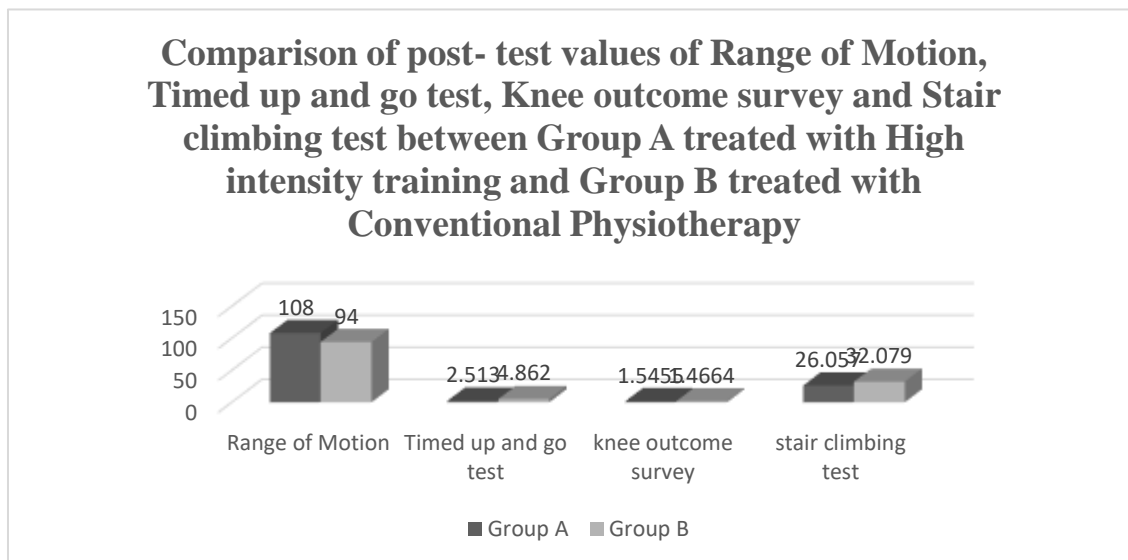




Table 3: Comparison of post- test values of Range of Motion, Timed up and go test, Knee outcome survey and Stair climbing test between Group A treated with High intensity training and Group B treated with Conventional Physiotherapy

Outcome scales	Independent ‘t’ test		‘t’ value	Level Of Significance
	High-Intensity Group	Conventional Group	Calculated ‘t’ value	
Range of Motion	108	94	6.5393	0.0541*
Time - Up and- Go test	2.513	4.862	10.7279	0.424**
Knee Outcome Survey –Activities of Daily Living Scale	1.5455	1.4664	2.0753	0.817**
Stair climbing test	26.057	32.079	3.9831	0.612 **

Graph 3



Discussion

Total knee arthroplasty is routinely performed surgical procedure for end-stage osteoarthritis to alleviate pain. Total knee arthroplasty patients have loss in quadriceps strength, range of motion and functions.¹⁵ The deficits are recovered after the post-operative exercises. This study was aimed to find the effectiveness of Early High-Intensity exercises in improving range of motion and functional performance after total knee arthroplasty.

20 subjects who had undergone primary unilateral total knee arthroplasty were selected for this study by purposive sampling. Then the subjects were divided into two groups: **group- A 10** subjects and **group- B 10** subjects.



Functional activities are measured using time-up and-go test and stair climbing test. Results in time-up and-go test indicated that post-test 't' value in independent 't' test was 2.101 and calculated 't' value was 10.727. This shows that high-intensity group subjects have improvement in functional performance. At the same time result in stair climbing test also indicated that post-test 't' value in independent 't' test was 2.101 and

calculated 't' value was 3.9831 this also shows that high-intensity group shows improvement in functional performance.

In this study, knee outcome survey- activities of daily living scale was used to know the symptoms and functional capacities. Symptoms included in the scale were pain, swelling, limping, buckling, weakness and stiffness. Most of the patients in both the groups complained of severe pain for 2 weeks. Analgesic medication prescribed by the surgeon was taken by subjects to relieve the pain. After medication, patients started their exercises with adequate rest periods. Some patient complained of buckling in the conventional group, which occurred during walk. For such patients more isometric exercises were given for quadriceps muscle.

In knee outcome survey- activities of daily living scale, functional activities were assessed like walking, standing, stair climbing, stair descending, squatting, kneeling, sitting with knees bent, getting up from chair. In that scale squatting, kneeling, sitting with bend knees are avoided after replacement surgery due to chance of loosening of prosthesis. So these activities were not taken for analysis and calculation.

Improvement in the subject's condition is seen within 4 weeks after surgery. After 1 month the improvement in functional activities was at slower pace.

Range of motion in independent's' test the posttest value mean was 108.50 in high-intensity group and in conventional group mean was 94. Mean itself shows there is a significant effectiveness in high-intensity group to improve range of motion.

The meta-analysis done in ...states that there is no effect of physical management in total knee arthroplasty. But this study proves that there is positive effectiveness in high-intensity exercises in total knee arthroplasty.²³

Results stated that early high-intensity exercises improved the functional activities and range of motion by improving strength of the muscles. In this study there are differences between the groups in treatment sessions. In High-Intensity group patients received treatment daily in 6 weeks. But in a conventional group, the patients received treatment totally 16 times in 6 weeks. This difference in treatment intensity made the high-intensity patient to improve in their functional performance and range of motion than conventional group.

Conclusion

Adding 6 weeks program of High intensity training combined with conventional physiotherapy will be effective in Range of Motion, Timed up and go test, knee outcome score and Stair climbing test in individuals with Total Knee Arthroplasty. It is suggested a similar study with a larger number of participants compared with another experimental group.



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