

Comparison of the Effects of Weight Bearing and Non-weight Bearing Exercise on Pain, Range of Motion and Disability in patients with Total Hip Replacement

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ABSTRACT

Objective: To compare the effects of weight bearing and non-weight bearing exercise on pain, range of motion and disability in patients with total hip replacement.

Study Design: Randomized clinical trial

Place and Duration of Study: Outpatient department of Physical Therapy, Winner Health Care Hospital Gujranwala /6 months

Methodology: The study was conducted on 22 patients that undergo total hip replacement. All patients randomly allocated to weight bearing exercise group and non-weight bearing exercise group. Both groups received 12 treatment sessions for 6 weeks. Numeric Pain Rating Scale, Goniometer, hip disability and osteoarthritis outcome score were used to measure the treatment effect at baseline and after 6 weeks treatment of total 12 sessions in 6 weeks, with 2 sessions per week. The clinical trial number of this study is NCT05375565.

Results: This study showed that pretreatment p value of numeric pain rating scale was 0.401 and of post treatment session was 0.270 which showed that there was a significant decrease in pain level in both groups. Range of motion also improved after taking intervention in both groups. In both groups, total hip disability and osteoarthritis outcome score in weight bearing exercise group was 21.05% at pre level and was 56.42% at post level while in non-weight bearing exercise group total HOOS score was 22.68% at pre level and 39.78% at post level.

Conclusion: Weight-bearing exercise had proved to be more effective in treating disability as compared to non-weight bearing exercise in patients undergoing THA. However, there is an equal effect on both groups on range of motion and pain intensity.

Keywords: Pain, patients, range of motion, total hip replacement, weight bearing.

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INTRODUCTION

Osteoarthritis involving the hip joint becomes significant public health problem. It was assumed that in 2030, there will be about 41.1 million Americans affected by osteoarthritis, and as a consequence of huge prevalence of this disease, the total hip replacement is expanded to 572,000 primary surgeries and the Revision surgery for hip arthroplasty is also estimated to increase twofold and risk of revision surgeries becomes high in patients having spinal pathology.¹

OA can be treated by pharmacological, non-pharmacological (including physical therapy that have a strong evidence as a treatment to enhance function level and decrease pain level in patients with minor to moderate symptoms of hip joint osteoarthritis) or surgically, with the dominant surgical use of

arthroplasty for end-stage hip joint osteoarthritis. Aging, obesity and female gender are among the risk factors for OA. Because of aging population and the growing obesity ratio, the frequency of hip joint OA is advancing in the world, resulting in a excessive need for THA. The World Health Organization (WHO) now considers osteoarthritis as among the leading diseases of the twenty-first century.² OA more dominantly effect feet, knee, hip and hand joints. Total hip arthroplasty (THA) is offered in order to decline the pain level of patients and for the betterment of functional level in last stage hip joint osteoarthritis patients.³

Although THA improves pain and patient-reported satisfactory outcome but lots of subjects going through total hip joint replacement manifest some kind of functional limitations and impairments⁴. For improving lower limb muscle strength and functional level in THA patients, postoperative rehabilitation was used as an effective method. And early weight bearing exercise showed effective results

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in improving disability and quality of life after THA. Current physio-therapy practice for post THA individuals concentrate on overcoming the impairments and boosting person's independent mobility. In previous studies it was concluded that patients who undertake functional exercise program through physiotherapy postoperatively, between 12 and 18 weeks after THR may attain significantly improved functional level when compared with patients that go through usual routine care. Apart from resolution of pain and improvement in perception of abilities, negligible development have been measured in physical activity following one year after THA, demonstrated that mostly patients acquire no need for an active lifestyle. After THA, level of physical activity may not improve without focusing on interventions and evidence based rehabilitation protocols require for the up gradation of physical activity in which the exercise participation is a lacking element.⁵

The current study is design to determine the effects of weight bearing and non-weight bearing exercises to improve pain, range of motion and disability in patients undergoing total hip replacement. In addition, it hypothesized that weight-bearing exercise with conventional exercise was more effective in improving pain, range of motion and disability as compared to non-weight bearing exercise in total hip arthroplasty patients. The rationale of this study is to provide better treatment technique which will help in improving hip range of motion and overcoming the disability and pain in patients after total hip replacement. It may help to provide the clinicians evidence in selecting better treatment strategy.

METHODOLOGY

This study was randomized clinical trial (Clinical Trial Number: NCT05375565) conducted in the outpatient department of Physical Therapy, Winner Health Care Hospital Gujranwala, within the time duration of 6 months. Sample size was calculated by online epitool calculator by taking confidence interval 95%, margin of error 5%, mean numeric pain rating of group 1 as 6.6 ± 0.95 and mean numeric pain rating of group 2 as 5.45 ± 0.65 . The estimated sample size came out to be 22 patients. Non-probability convenient sampling technique was used to collect data. Patients were randomly divided into two groups: group A (weight-bearing exercise with general physiotherapy)

and group B (non-weight-bearing exercise with standard physiotherapy.)

Inclusion Criteria: Patients of either gender with age range between 35-60 yrs. presented after 1-week post-operative history of unilateral total hip arthroplasty, with lateral surgical approach were included in this study

Exclusion Criteria: Patients with history of any systemic pathology, congenital hip disease, bilateral total hip arthroplasty, Revision total hip arthroplasty, evidence of CNS involvement, any red flag malignancies or any kind of tumor, history of lower extremity fracture and any local or systemic infection of the hip joint were excluded from the study

Data collection tools were numeric pain rating scale (NPRS), hip disability and osteoarthritis outcome score (HOOS) and goniometer.

After taking, consent (REC/RCR & AHS/22/0140) a complete physical examination, history and thoroughly assessment done by the researcher and patient completed the numeric pain rating scale as subjective measurement, active ranges of the patient involved hip was taken through goniometry, After that pre HOOS score was calculated. Then treatment continued to the selected subjects according to their allocation. As group A receive weight bearing exercises while group B receives non-weight bearing exercises in addition to that both group received standard physiotherapy protocol. Both groups undergo two physiotherapy sessions per week and after a total duration of 6 weeks including 12 sessions (each session lasted for about 50 minutes). Patients then reassessed by the researcher and then complete the NPRS and HOOS score and hip ranges that calculated through goniometer. The intensity of the exercise was to load the operated limb as much as tolerated. Apart from specific weight bearing and non-weight, bearing exercises patients also received general mobility and ROM exercises.

General Exercises that were given to both groups included (Bed supported knee bends 10 rep x set's, Ankle rotation 10 rep after every 2 hours, Ankle pumps 10 rep x 2 sets, Buttock contraction 10 rep x set's, Abduction exercises 15 rep x set's, Quads sets 10 rep x 2 set's, range of motion and mobility exercises including standing, sitting and walking with the use of walker)

Specific weight bearing exercise for group A were (Standing knee raise 10 rep x 2 set's, Standing knee

Disability in patients with Total Hip Replacement

bend 10 rep x set's, Standing hip extension 10 rep x set's, shallow squats 5 rep x 2 sets) . In addition, After 4 weeks gradually restricting the use of assistive device when patient become able to walk and stand for 10 minutes then add stair climbing and descending with a step height not higher than 7 inch.

Specific non-weight bearing exercises for group B were (Seated knee flexion 10 rep x 2 sets Seated knee extension 10 rep x 2 set's Use of stationary bicycle 10 minutes, Side lying leg lift 10 rep x 2 sets Straight leg raise 10 rep x 2 set's)

The data were analyzed using Statistical Package for the social sciences (SPSS) version 21. In addition, the statistical significance was set at $p < 0.05$. Normality of the data was checked through Shapiro wilk test. Inter group difference evaluated with Mann-Whitney and intra group pre and post treatment values evaluated with Wilcoxon signed ranks test.

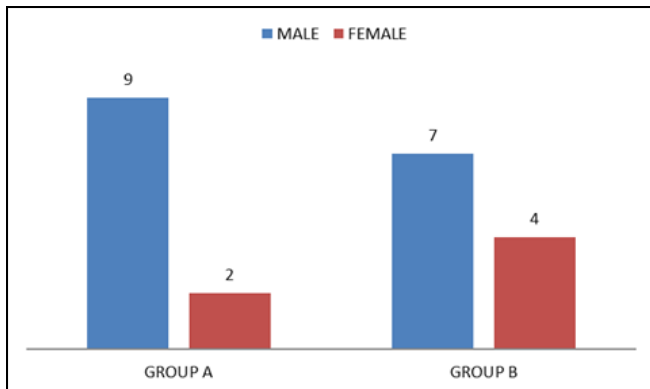


Figure-I: Bar Chart of Patient Gender in Both Groups

RESULTS

The gender distribution was depicted as out of total 22 participants, 16 males (73%) and 6 females (27%). Age of participants in Group A was 56.91 ± 6.80 the maximum age of participants in group A was 62 years and minimum age 38 years . While in Group B age was 57.27 ± 6.93 with maximum age of participants was 70 years and minimum age 43 years.

Total 22 participants were included with minimum BMI 19.6 Kg/m^2 and maximum BMI was 29 Kg/m^2 . For group A, BMI was $23.88 \pm 2.19 \text{ Kg/m}^2$ and for group B BMI was $24.0 \pm 2.8 \text{ Kg/m}^2$.Out of total 22 participants 15 were fall in category of normal or healthy weight in between (18.5-24.9) with BMI 68.21%. Moreover, 7 participants were with fall in overweight category (25.0-29.9) which overall accounts for 31.8 % of total sample size

Table I showed pre-treatment and post treatment comparison of group A and group B change followed

by physiotherapy interventions used in that treatment session. According to that test, pretreatment p value of numeric pain rating scale was 0.401 and of post treatment session was 0.270 which showed that there was a significant decrease in pain level in both groups. It also showed that range of motion also improved after taking intervention in both groups. Total hip disability and osteoarthritis outcome score in weight bearing exercise group was 21.05% at pre level and was 56.42% at post level while in non-weight bearing exercise group total HOOS score was 22.68% at pre level and 39.78% at post level. So weight bearing exercises is more effective in treating disability.

Table-I: Between Group Comparison of Group A And Group B Using Man-Whitney Test

Parameters	Study Groups		p-value
	Pre treatment Median (IQR)	Post treatment Median (IQR)	
PAIN	8.00(1.00)	2.00(1.00)	0.270
HIP FLEXION	20.00(10.00)	85.00(10.00)	0.438
HIP EXTENSION	5.00(5.00)	15.00(5.00)	0.748
HIP ABDUCTION	15.00(5.50)	30.00(10.00)	0.088
HOOS	21.00(3.35)	43.00(16.46)	0.001

Table-II showed within group comparison of group A and B after pre and post treatment session following by physiotherapy intervention used in that study.

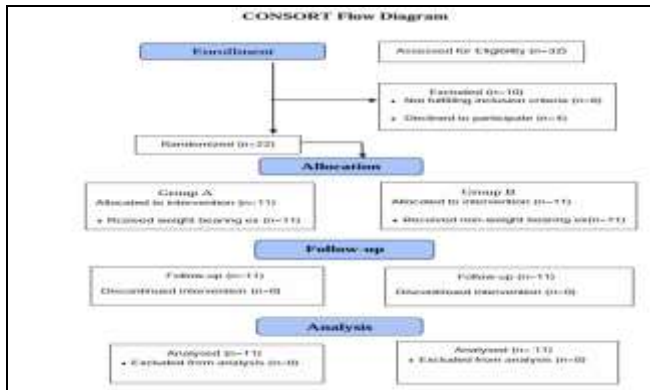
Table-II: Within Group Comparison Of Group A and B For Change in Pain Intensity, Range Of Motion and Hoos Score Using Wilcoxon Signed Ranks

Parameters	Study Groups		p-value
	Group A (n=11) MEDIAN (IQR)	Group B (n=11) MEDIAN(IQR)	
PAIN	2.00(1.00)	2.00(1.00)	1.000
HIP FLEXION	85.00(15.00)	90.00(20.00)	0.003
HIP EXTENSION	15.00(5.00)	15.00(5.00)	1.00
HIP ABDUCTION	30.00(5.00)	30.00(5.00)	1.00
HOOS	56.91(11.30)	40.6(2.50)	0.002

DISCUSSION

Current study showed that both weight bearing exercise and non-weight bearing exercise group along with general mobility and range of motion exercises showed equally significant improvement in hip range of motion including hip flexion, hip extension and hip abduction after taking intervention in THA patients . And the results of my study were in accordance with the study conducted by Shivangini Patel *et al* in 2021

in which physiotherapy exercise including range of motion exercises showed significant improvement in hip flexion, hip extension and hip abduction in patients after THA.⁵



Consort Flow Diagram

In current study, statistical significant *p* value of NPRS for pretreatment session of both groups was 0.401, which was high than post treatment session significant value of 0.270 showed that there was a significant decrease in pain level after taking intervention in both groups. These results were in accordance with the study conducted by Bilal Fayyaz et al conducted in 2021, in which 22 patients were divided into two different groups i-e Group A that received hip muscles motor control training with conventional physiotherapy while group B received only conventional Physiotherapy the mean NPRS score for group A was 5.64±0.67 in the start and was 2.36±0.81 at the end of treatment .while in group B mean value for NPRS was 5.45±1.¹³ at the start and 3.55±0.82 at the end of treatment , this showed more effectiveness of motor control training along with conventional physiotherapy in reducing pain level.⁷

In this current study, HOOS score calculated in weight bearing exercise group was 21.05 at pre level and was 56.42 at post level while in non-weight bearing exercise group total HOOS score was 22.68 at pre level and 39.78 at post level. That concludes that weight-bearing exercise was shown to be more effective in reducing disability and pain symptoms in THA patients and the results were in accordance to a study conducted by Bilal Fayyaz et al in 2021 in which Motor control training along with conventional physiotherapy effectively improving the HOOS score in THA patients compared to conventional physiotherapy alone.⁸

Pengtian et al conducted a meta-analysis in 2017 to investigate the safety and efficacy of partial weight

bearing (PWB) vs early full weight bearing (FWB) after total hip arthroplasty (THA) through different database including EMBASE, The Cochrane Library, PubMed and Web of Science. And the meta-analysis concluded that early FWB could be safe and would not increase the prevalence of postoperative complication in patients undergoes total hip arthroplasty.⁹ And the current study showed more effective results of weight bearing exercise as compared non-weight bearing exercise in improving disability and quality of life after total hip replacement.

Marco monticone et al conducted an RCT in 2014 to evaluate the effectiveness of task-oriented exercises associated with early full weight bearing in patients undergoing total hip joint replacement. A total of 100 patients were taken that randomly divide into control group(treated with partial weight bearing) and experimental group (early weight bearing) the study result showed that task-oriented exercises associated with early full weight-bearing improve pain, disability, activities of daily living, and quality of life after total hip joint replacement.¹⁰ Current study findings showed that weight bearing exercise were more effective as compared to non-weight bearing exercise in improving disability and quality of life.

A.Hermann et al conducted a randomized control trial in 2015 on the effectiveness of preoperative progressive resistance training on the outcomes of total hip replacement. This study showed that it significantly improves self-reported outcomes and there is an increase in muscle power.¹¹ Kazunari Ninomiya et al in 2022 conducted a research on the effectiveness of exercise along with nutritional supplements in total hip replacement outcomes. The results showed a significant improvement in exercise plus nutrition group.¹² On the other hand current study only focuses on the treatment after total hip replacement.

An RCT was conducted in 2022 by L.Groot *et al* on the outcomes of postoperative physical therapy after total hip replacement in relation to the presence of comorbidities. This study showed that there is worse recovery in those patients that have comorbidities.¹³ the current study excludes the individuals that have comorbidities. Another research by Angela Elizeth *et al* in 2020 conducted on the comparison of accelerated rehabilitation with conventional rehabilitation in postoperative total hip replacement. The focus of this study was only weight

bearing gait etc. the result showed betterment of accelerated physiotherapy.¹⁴ Kathleen C.Madara et al in 2019 conducted a pilot study on the effect of progressive rehabilitation in postoperative total hip replacement. The results showed a positive impact.¹⁵ The current study compares mainly weight bearing and non-weight bearing exercises effect.

C.Abbas along with college in 2017 conducted a pilot study on the effect of closed chain kinetic exercises in postoperative total hip replacement. The results showed that these exercises are well tolerated in acute settings.¹⁶ This study focuses only the weight bearing exercises (closed chain) but the current study compares both. So far, the researcher's best knowledge, limited study conducted on the comparison of open and close chain exercises in postoperative total hip replacement. Another study by Rossi et al in 2007 compare close and open chain measures in total knee replacement. It showed more significance of closed chain measures.¹⁷ A research by Clarissa Matheis in 2018 on the effect of strength training and mobilization training on the functional outcomes after total hip replacement is done. This study focuses on the weight bearing exercises and concluded that there are significant effect of full weight bearing exercises.¹⁸ In contrast, the current study look into insight on the both components of exercises i.e weight bearing and non-weight bearing.

LIMITATION OF STUDY

The current study has few limitations including no follow up later after the completion of study. So the results of this study can be implicated for only short-term duration.

There was no blinding and patient concealment was a big limitation.

Data was collected through specific population so it is difficult to generalized results over whole population

CONCLUSION

Weight-bearing exercise had proved to be more effective in treating disability as compared to non-weight bearing exercise in patients undergoing THA. However, there is an equal effect on both groups on range of motion and pain intensity.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

HT: & HG: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

RM: & SNJ: Data acquisition, data analysis, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Disability in patients with Total Hip Replacement

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