

## EFFECTIVENESS OF EARLY BALANCE EXERCISES ON TOTAL HIP ARTHROPLASTY

*Phyu Sin Oo\**, *Than Win \*\**, *Brang Mai\*\**, *Myo Tint Tun\*\*\**, *Cho Cho Htwe \*\*\**

**\*Department of Physiotherapy, University of Medical Technology, Mandalay, Myanmar**

**\*\*Department of Orthopaedics, University of Medicine, Mandalay, Myanmar**

**\*\*\*Department of Physiotherapy, University of Medical Technology, Mandalay, Myanmar**

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### Abstract

**Background:** Patients receiving total hip arthroplasty (THA) without a rehabilitation program could develop functional limitation within one year after surgery. Exercise for balance control is critical for mobility, physical function and prevention of falls. Few studies have investigated the effectiveness of balance training among THA patients.

**Objective:** The study aimed to investigate the effectiveness of early balance exercises on THA.

**Methods:** This study was a randomized control study for 30 patients undergoing unilateral THA. The postoperative rehabilitation program was started at the second postoperative day for every patient. All the postoperative patients were randomly assigned and equally allocated to balance and conventional groups. Patients in the balance group received typical exercises and balance exercises while those in the conventional group received typical exercises alone. Assessments were taken at postoperative day 2 (baseline) and week 5 using Berg Balance Scale for balance and Timed Up and Go Test for ambulatory function. The differences between the two groups were analyzed.

**Results:** Statistically significant improvements were noted at the end of treatment by all outcome measures in both groups ( $p < 0.05$ ). However, the balance group showed better improvement in all outcome measures than the conventional group after the intervention period ( $p < 0.05$ ).

**Conclusion:** Early balance exercises added to typical exercises were more effective than conventional exercises in terms of improving balance and ambulatory function among patients with THA.

**Keywords :** Early balance exercises, Total hip arthroplasty

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Correspondence to:

Phyu Sin Oo, Department of Physiology, University of Medical Technology, Mandalay, Myanmar

E-mail: [Patriciaphyusin@gmail.com](mailto:Patriciaphyusin@gmail.com)

## Introduction

Total hip arthroplasty (THA) is one of the most common and successful surgical procedures widely used to treat of end stage joint disease, relieving pain, providing functional recovery and improving hip joint stability and quality of life.<sup>(1, 2)</sup> Over one million of THA are performed yearly worldwide and is anticipated to double within the next decade.<sup>(3)</sup>

The most common reason for THA is the presence of severe pain with functional limitation<sup>(2)</sup> especially, among patients presenting osteoarthritis, rheumatoid arthritis, avascular necrosis, traumatic arthritis, hip fractures, benign and malignant bone tumors.<sup>(4)</sup> Impaired balance, muscle weakness, decreased range of motion and diminished functional mobility are common problems exhibited after THA.<sup>(5)</sup> After THA, the ability to perform activities of daily living generally improves, but some functional limitations such as impairment in postural balance and walking ability may still persist.<sup>(6)</sup>

Patients receiving THA without a rehabilitation program will develop functional limitation within one year after surgery.<sup>(7)</sup> Long lasting impairments were found to be reduced regarding balance control after THA so exercise for balance control is critical for mobility, physical function and prevention of falls.<sup>(8)</sup> Therefore, adequate and timely postdischarge physiotherapy is very important to restore a patient's physical function and quality of life.<sup>(9, 10)</sup> Impairment in balance is a major cause of falls. Up to 30% reduced muscle strength has been found after THA.<sup>(11)</sup> Early and persistent loss of muscle function and impaired balance after THA have increased risk of falling within the first months of this surgery.<sup>(11)</sup> Falls are most frequent during the early discharge period, with 24.1% occurring within the first week and 51.8% within the first month.<sup>(5)</sup> Ikutomo et al. stated that 42.9% of THA patients had experience of fall within the early postoperative period after THA, while Jorgensen and Kehlet reported 25% of patient experienced a fall within two years after THA.<sup>(12, 13)</sup>

After falling, potential complications such as fractures and other injuries, as well as more lasting effects, disability and fear of falling can occur.<sup>(11)</sup> Thus, intensive physiotherapy in the early postoperative phase may be indicated as a rationale to reduce balance impairment and

muscle weakness to lower surgery-related falls.<sup>(11)</sup> Moreover, early weight bearing after THA reduces the bone demineralization from decreased weight bearing and provides earlier recovery of functional mobility.<sup>(5)</sup>

Trudelle-Jackson and Smith stated that an exercise program emphasizing weight bearing and balance exercises significantly improved muscle strength, balance and self-perceived function among patients undergoing THA.<sup>(14)</sup> Jogi et al. investigated balance exercises in addition to typical joint range of motion and muscle strengthening exercises in the acute postoperative phase following THA. The study reported a five-week intervention period resulted in significantly greater improvements in balance and functional mobility compared with a typical postoperative physical therapy program alone.<sup>(13)</sup>

Few studies have investigated the effectiveness of balance training among THA patients. However, the balance exercises were not started as early as postoperatively. Furthermore, evidence is lacking regarding the effectiveness of early balance exercises in THA. The purpose of this study was to compare the effectiveness of early balance exercises plus typical exercises and typical exercises alone among THA patients.

## Methods

### Study design and settings

The study employed a hospital-based randomized control design. Thirty patients with total hip arthroplasty from the Mandalay Orthopaedic Hospital, Mandalay, Myanmar were included according to selection criteria. The study period was from May 2017 to August 2018. All patients were explained thoroughly about the study and signed a written informed consent form to participate. Ethics approval was obtained from Ethics Review Committee of the University of Medical Technology, Mandalay, Myanmar.

### Inclusion and exclusion criteria

Patients aged more than 18 years and unilateral cases of THA were included in the study. Exclusion criteria included pain with weight bearing on unaffected extremities and patients presenting postoperative complications such as deep vein thrombosis and surgical

site infection within the study period.

#### Intervention/Procedure

Patients meeting the eligibility criteria were randomly assigned to conventional (n=15) and balance groups (n=15) using block randomization. Patients in both groups received typical exercises but early balance exercises were included only in the balance group.

Typical exercises included in this study were isometric quadriceps and glutei, ankle pumps, active assisted hip and knee flexion and extension, active assisted hip abduction, short arc quads, active hip flexion, active hip extension, active hip abduction, active knee flexion and active knee extension exercises.

All the patients in the balance group were given early balance exercises and typical exercises. From postoperative day 2 to postoperative day 7, patients in the balance group started weight shifting exercises. From postoperative week 2 to week 5, forward knee lunge, trunk rotation and heel raise exercises were included. All the patients in both groups were allowed to perform each exercise for ten times per session, three sessions per day for five weeks duration. Initially, exercises were properly demonstrated to the patients and caregivers by the researcher. After discharge, all patients were provided with pamphlets including written exercises and photographs. And

then, checking was conducted once a week by the researcher regarding whether the patients could perform exercises properly and correctly. The intervention period was five weeks.

#### Assessment

Outcomes were assessed using the Berg Balance Scale (BBS) and Timed Up and Go Test (TUG) at postoperative day 2 (baseline) and at the end of week 5. BBS was used to assess the static and dynamic balance and TUG was used to assess the patient's ambulatory function.<sup>(15, 16)</sup>

#### Statistical Analysis

Data were analyzed using STATA Statistics Software, Version 13.0. To compare demographic data between groups, the two sample *t*-test and chi-square test were used. Intragroup analysis of each group was performed using the paired *t*-test to determine the changes in mean output variables. Intergroup analysis was performed using the two sample *t*-test. The results were considered statistically significant when *p*-value was less than 0.05.

#### Results

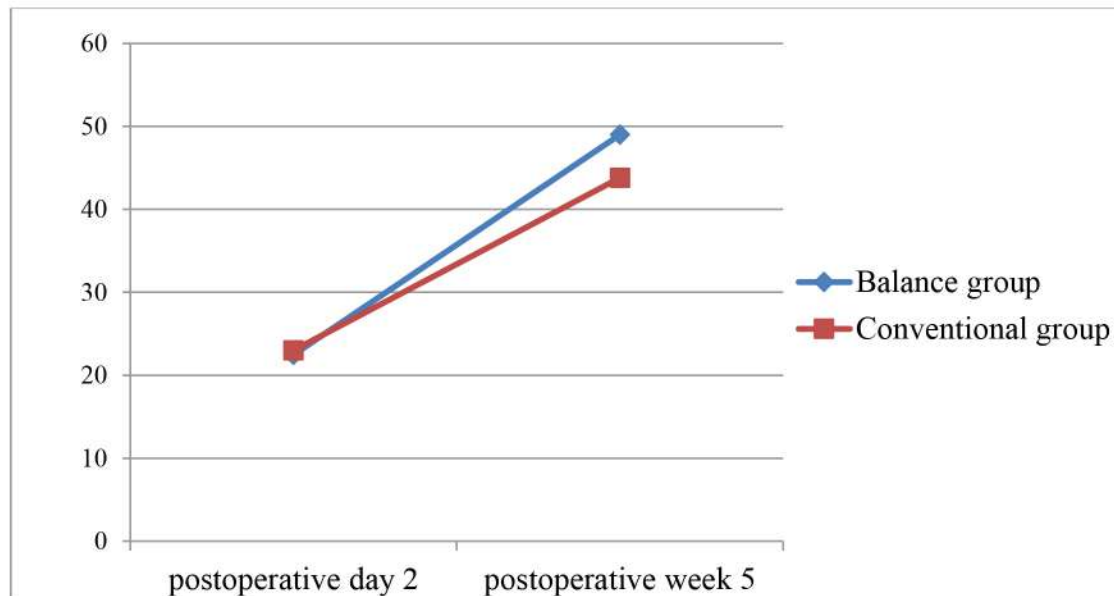
The baseline demographic characteristics of the 30 patients showed no statistically significant difference as shown in **Table1**.

**Table1.** Demographic characteristics of the patients in both groups

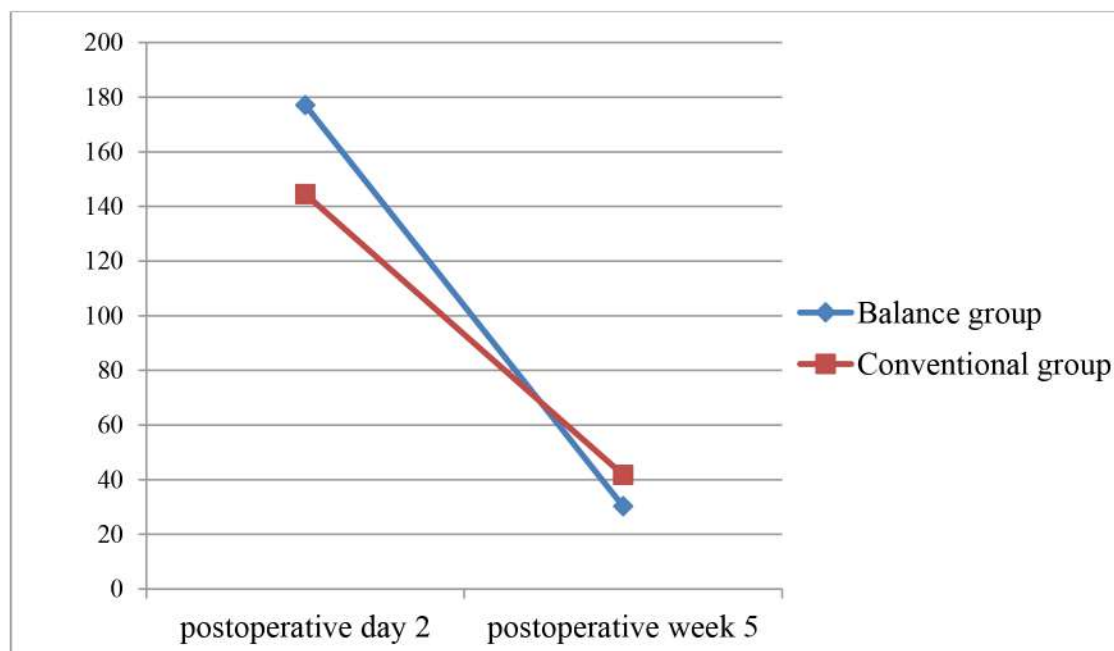
Variables		Conventional group	Balance group	<i>p</i> -value
Age (Mean year, SD)		47.3 (15)	39 (11.7)	0.10
Sex	Male	7	6	0.71
	Female	8	9	
Side of operation	Left	5	8	0.269
	Right	10	7	
	Osteoarthritis	3	2	
Reasons for surgery	Avascular necrosis	8	9	0.85
	Fractures	2	1	
	Others	2	3	

Baseline scores of the Berg Balance Scale and Timed Up and Go test in the balance group and conventional group also did not differ significantly ( $p = 0.76$  and  $0.15$ , respectively). However, scores of the Berg Balance Scale and Timed Up and Go Test significantly improved

after treatment in both groups. After completing the 5-week treatment, a more significant improvement in Berg Balance Scale (**Fig. 1**) and Timed Up and Go Test scores (**Fig. 2**) was noted in the balance than the conventional group.



**Figure 1.** Comparison of Berg Balance Scale scores between two groups



**Figure 2.** Comparison of Timed Up and Go Test scores between two groups



**Table 2.** Showing pre-intervention and postintervention of Berg Balance Scale and Timed Up and Go Test scores of both groups

Variables	Treatment	Conventional group mean $\pm$ SD	Balance group mean $\pm$ SD	<i>p</i> -value
Berg Balance	postoperative day 2	23 $\pm$ 5.04	22.47 $\pm$ 4.29	0.76
Scale	postoperative week 5	43.8 $\pm$ 3.9	49 $\pm$ 3.74	0.0009
	<i>p</i> -value	<0.0001	<0.0001	
Timed Up and	postoperative day 2	144.4 $\pm$ 63.42	177.07 $\pm$ 57.86	0.15
Go test	postoperative week 5	41.73 $\pm$ 9.82	30.2 $\pm$ 11.54	0.0064
	<i>p</i> -value	<0.0001	<0.0001	

## Discussion

The present study showed the balance group improved in balance and ambulatory function among patients with THA than that of those in the conventional group. Jogi et al. (2015) reported greater improved balance measures such as Timed Up and Go Test (TUG) scores and Berg Balance Scale (BBS) was observed in the balance group after 5-week intervention following balance exercises in THA patients. However, no significant differences were observed in both study groups concerning the WOMAC-function and Activities-specific Balance Confidence (ABC) Scale.<sup>(13)</sup> The present study proved early balance exercises had a positive impact on balance control and ambulatory function in terms of BBS and TUG after the 5 week intervention. The main difference between Jogi et al. (2015) and this study involved the type of balance exercises and commencement of balance exercises after THA. The present study started the balance exercises earlier than the Jogi et al. study.

A randomized controlled trial of Liao et al. (2013) evaluated the effects of balance training on functional outcomes after total knee replacement among patients with knee osteoarthritis including 58 patients in an experimental group and 55 patients in a control group. Improved balance control

was found in the experimental group after the eight-week intervention. They concluded that balance exercises had a significant benefit on mobility and functions of patients with knee osteoarthritis after total knee replacement.<sup>(15)</sup> Similar improvement in balance and mobility function was observed after balance training in related studies of other health conditions.

A study by Madureira et al. conducted a 12-month randomized controlled trial of balance training among elderly women with osteoporosis in 2010 reporting the long-term balance training program provided improved balance, reduced in risk of fall and benefitted overall health quality of life.<sup>(17)</sup> Smania et al. (2010) evaluated the effect of balance training concerning postural instability among patients with idiopathic Parkinson's disease and concluded that such training had a positive effect on balance control at the end of treatment and that improvement was maintained at one-month follow-up.<sup>(18)</sup> Sparrow et al. (2016) reported a highly challenging balance program for three months was effective in reducing fall rate and improving balance control among patients with Parkinson disease.<sup>(19)</sup> The randomized controlled trial of Monticone et al. (2017) observed balance task-specific training had a beneficial effect on balance,

physical function and quality of life among patients with hip fracture patients compared with general physiotherapy after three-week intervention.<sup>(20)</sup>

Limitations of this study included the small sample size, lack of blinding system, and lack of long term follow-up. Further studies should be conducted using a larger sample size, different outcome parameters and long term follow-up period to determine maintenance effects of intervention to patients. Different patient populations needing improve balance and ambulatory function should also be enrolled.

## Conclusion

The present study concluded that typical exercises including balance exercises are better than typical exercises in terms of balance and ambulatory function. Thus, significantly improved balance and ambulatory function could be obtained with early balance exercises included in typical exercises among patients with THA.

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