

ORIGINAL ARTICLE

Recovery and Prediction of Physical Functioning Outcomes During the First Year After Total Hip Arthroplasty

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Abstract

Objectives: To investigate recovery of physical functioning in patients during the first year after total hip arthroplasty (THA), and to predict postoperative walking distance outcomes from preoperative measures.

Design: A longitudinal prospective design was used. Data were analyzed by repeated-measures analysis of variance and multivariate regression analyses.

Setting: Two hospitals.

Participants: Patients with hip osteoarthritis were consecutively included and assessed preoperatively (n=88), at 3 months (n=88), and at 12 months (n=64) after THA.

Interventions: Not applicable.

Main Outcome Measures: Physical functioning was assessed by objective measures—the 6-minute walk test (6MWT), stair climbing test, Index of Muscle Function, figure-of-eight, and active hip range of motion—and the subjective measures by Harris Hip Score and Hip dysfunction and Osteoarthritis Outcome Score.

Results: In objective measures, improvements were found from preoperatively to 3 months in 6MWT ($P<.01$) and stair climbing test ($P<.05$) scores, while all measures had improved from 3 to 12 months ($P\leq.001$). In contrast, all the subjective measures showed substantial improvements at 3 months, but small further improvements from 3 to 12 months ($P<.001$). Age, sex, preoperative 6MWT distance, and hip range of motion predicted 6MWT outcomes at 3 and 12 months ($P\leq.01$).

Conclusions: The objective measures of physical functioning improved gradually during the first postoperative year, while the subjective measures showed large early improvements, but little further improvements. Younger age, male sex, and better scores of walking distance and hip flexibility before surgery predicted better score in walking distance at both 3 and 12 months after surgery.

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Patients with hip osteoarthritis (OA) suffer from pain and disabilities. When conservative treatment no longer is effective, total hip arthroplasty (THA) is the treatment of choice. During the last couple of decades, the evaluation of outcomes after THA has shifted from focusing on success or failure of the implant to evaluate pain relief, improvements in physical functioning, and quality of life.^{1,2}

A systematic review showed that patients with THA may experience considerable pain relief already a few days after surgery,^{3,4} and

after 3 months pain intensity measures were reduced by approximately 60%.⁵ Recovery of physical functioning has been evaluated by objective measures of performance, such as walking distance,⁶ and by subjective measures, such as the Western Ontario and McMaster Universities Osteoarthritis Index.^{2,7} Compared with preoperative scores, a deterioration in objective measures of walking distance within the first postoperative weeks, small improvement at 3 months, and further gradual increase to 12 months postoperatively have been reported.⁸⁻¹¹ A different pattern has been revealed when the recovery of physical functioning was assessed by subjective measures. Approximately 50% improvement in Western Ontario and McMaster Universities Osteoarthritis Index physical functioning score was

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reported from preoperatively to 3 months postoperatively,^{5,10} with further small improvements found at 6 and 12 months.^{5,11,12} Thus, the pattern of recovery seems to be different depending on whether it is evaluated by objective or subjective measures.

Studies examining the recovery of physical functioning after THA have mostly applied either subjective or objective measures.¹³ Two studies applied both subjective and objective measures to assess the outcomes at least twice.^{14,15} In these studies, most of the improvements in both objective measures and subjective measures of physical functioning occurred within the first 3 months and only small further improvements were found thereafter. These results are in contrast to the aforementioned studies. Thus, it cannot be concluded what to expect with regard to the course of recovery of physical functioning. To address this issue further, our patient sample was assessed by both subjective and objective measures of physical functioning preoperatively and during the first year after THA.

For patients and health professionals to give realistic expectations and set attainable therapeutic goals, it is important to know whether the patients' preoperative physical functioning is of any significance to how their physical functioning will become postoperatively. Prior studies have shown that advanced age, female sex, multiple comorbidities, low patient expectations, high levels of preoperative pain, and poor preoperative self-reported physical functioning scores predict worse postoperative self-reported physical functioning after THA.¹⁶⁻²⁰ Many patients desire to improve their walking ability after surgery, and walking ability is an important factor for living an active life and being independent in daily activities.²¹ We have, however, not found any studies predicting the outcome in an objective measure of walking distance after THA. Presently, we assumed that a patient's walking ability before surgery was related to the outcome in walking ability after surgery. Furthermore, patients applying for THA have often impaired hip flexibility and balance, which we think may influence walking ability. We also presumed that patients who lead a physically active life before surgery may achieve a good result from surgery. Thus, these variables were entered as plausible predictive factors in a regression model together with age, sex, and preoperative pain severity.

The aims of this study of patients with THA were as follows: first, to examine the changes in physical functioning assessed before surgery and at 3 and 12 months after surgery by objective and subjective measures, and second, to examine which preoperative measures of physical functioning could predict walking distance outcomes at 3 and 12 months after THA.

Methods

Study design, participants, and ethics

This article reports analysis of longitudinal data collected preoperatively and at 3 and 12 months after THA. The 12-month data were also

List of abbreviations:

HOOS	Hip dysfunction and Osteoarthritis Outcome Score
IMF	Index of Muscle Function
OA	osteoarthritis
ROM	range of motion
SCT	stair climbing test
THA	total hip arthroplasty
6MWT	6-minute walk test

applied to evaluate the long-term effects of an exercise program.²² This exercise program showed a minor effect on walking after 1 year. Thus, we have controlled for the exercise group in the statistical analysis.

Patients approved for primary THA were recruited from 2 hospitals in the Oslo area. They were enrolled from October 2008 to June 2010. Inclusion criteria were diagnosis of hip OA and residence within a radius of approximately 30 kilometers to the hospital, so that attending an exercise program after surgery could be possible. The exclusion criteria were OA in a knee or contralateral hip that restricted walking, as well as neurologic disease, heart disease, dementia, drug abuse, or inadequate ability to read and understand Norwegian. The study was approved by The Regional Committee for Medical Research Ethics and the Norwegian Social Science Data Services.

Patient characteristics

Before surgery, the patients completed a questionnaire including items on age, sex, body height and weight, educational level, marital status, and comorbidities.

Objective measures

6-minute walk test

The 6-minute walk test (6MWT) is a measure of walking ability. It measures the distance in meters walked indoors at a comfortable speed within 6 minutes.²³ The patients walked back and forth along a 40-meter corridor. A clinically relevant improvement is 50 meters.²⁴ The 6MWT is considered to be an adequate measure of physical functioning in subjects with OA and THA^{11,25} and is found to be reliable and valid.²⁶

Stair climbing test

The stair climbing test (SCT) also assesses walking ability. The patients ascended and descended 8 steps, each 16 centimeters high, as fast as they could without running. They used alternate legs and were allowed to support themselves by holding onto the stair rail. The time was measured in seconds.

Figure-of-eight test

The figure-of-eight test is a measure of balance. The patient walks within a double set of circles. The outer circles are 180 centimeters in diameter, and the inner circles are 150 centimeters in diameter. There is a 15-centimeter space between the lines in which the feet must be placed during walking. Every step on and outside the lines was registered, and the higher the number the worse the score. The figure-of-eight test is reported to be reliable and valid.²⁷

Index of Muscle Function

Index of Muscle Function (IMF) consists of tests of general mobility, muscle strength, balance/coordination, and endurance. The assessor evaluated the patient's performance on a 3-point scale (range, 0–2).²⁸ The total score ranges from 0 (best) to 40 (worst). The IMF is considered to be a valid and reliable measurement tool for patients with OA.^{28,29}

Active hip range of motion

The degree of active hip range of motion (ROM) in flexion and extension was measured by a goniometer,³⁰ summarized and reported as the total score for active hip ROM.

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