Outcomes of Total Hip Arthroplasty: A Study of Patients One Year Postsurgery

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Study Design: Ex post facto research using prospective analysis of differences between the involved hip and uninvolved hip.
Objectives: To assess outcomes of total hip arthroplasty (THA) by comparing range of motion (ROM), muscle strength, and postural stability in the surgical hip to those of the uninvolved hip 1 year postsurgery. An additional objective was to assess degree of relationship among ROM, strength, and postural stability impairments to a measure of self-assessed function.
Background: Most patients who have THA receive physical therapy that consists mainly of self-care instructions and an exercise protocol that emphasizes mobility during the acute phase of recovery. But, outcomes of THA 1 year postsurgery indicate that current physical therapy programs used during the acute phase of recovery do not effectively restore physical and functional performance.
Methods and Measures: Subjects consisted of 11 women and 4 men (mean age ± standard deviation = 62 ± 8 years) with unilateral THA performed 1 year prior to data collection. Assessment variables consisted of self-assessment of function and measures of postural stability, muscle strength, and hip ROM. The 12-Item Hip Questionnaire was used for self-assessment of function. Three separate repeated measures MANOVA were used to compare the involved side to the uninvolved side in measures of postural stability, strength, and ROM. The Spearman's rho was used to assess degree of association between the subjects' score of self-assessed function and impairments in strength and postural stability.
Results: Measures of postural stability were significantly lower ($P \leq 0.01$) on the side of the replaced hip. Differences in strength values between the involved and uninvolved sides were not statistically significant. Correlations between scores of self-assessed function and hip abductor and knee extensor strength were statistically significant ($r = 0.56$, $P \leq 0.03$). Self-assessed function was not significantly correlated to postural stability impairments.
Conclusion: The brief postsurgical rehabilitation program received by patients with THA may not be sufficient. A second phase of rehabilitation implemented 4 months or more after surgery that emphasizes weight bearing and postural stability may be advisable. *J Orthop Sports Phys Ther* 2002;32:260–267.

Key Words: *isometric strength, postural stability, self-assessed function, THA*

Total hip arthroplasty (THA) is one of the most widely performed surgical procedures in orthopaedic practice in the United States. An estimated 170,000 total hip arthroplasties are performed annually.[16] THA is most often performed to relieve pain and restore function in patients who have extensive damage to the hip joint as a result of osteoarthritis, rheumatoid arthritis, avascular necrosis, traumatic arthritis, certain hip fractures, or benign and malignant bone tumors.[14] Osteoarthritis alone accounts for 70% of elected THA cases.[16]

The most common preoperative complaints by patients who elect to have THA are pain and loss of mobility. Therefore, the most commonly reported outcomes of THA relate to pain relief and restoration of mobility. Outcome studies of pain reduction and range of motion, usually conducted 3 to 6 months following THA, indicate an overall satisfaction by patients and physicians.[1,6] Studies of muscle strength and functional outcome following THA are more limited and the results more varied. Shih et al[15] measured isometric muscle strength 1 year post-THA surgery in a group of 20 men with a preoperative diagnosis of unilateral osteonecrosis and a group of 20 women with a preoperative diagnosis of unilateral osteoarthritis. The investigators found that strength of the muscles surrounding the operated hip joint was 84–89% of the strength on the uninvolved side in the men and 79–81% of the strength on the uninvolved hip in the women. Long et al[12] used force platform measurements of vertical loading during ambulation to assess muscle strength indirectly. The investigators reported that significant residual muscle

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weakness persisted in the operated hip up to 2 years following surgery. Although the investigators classified the deficits they found as ''subclinical,'' they acknowledged that this persistent weakness could contribute to the higher rates of component loosening that have been reported in active patients. Long et al[12] found in their study of 18 subjects recovering from THA that deterioration of the Harris hip score and weakness of muscles during stance were the most consistent findings in subjects who developed loosening of the hip components. The authors suggested that the persistent muscle weakness could result in aching about the hip and provide reduced protection of the implant during endurance activities.

Lower-extremity muscle strength and postural stability have been shown to be factors that distinguish fallers from nonfallers. Studies by Gehlsen and Whaley[5] and Whipple et al[22] found that lower-extremity muscle strength and postural stability in single stance were significantly lower in groups of fallers than in groups of nonfallers. Additionally, Guralnik et al[9] found that measures of standing balance and lower-extremity muscle strength were highly predictive of the development of subsequent disability within the next 1–4 years. Postural stability outcomes in patients who have had THA have not been adequately investigated. Only 2 studies that address postural stability following THA could be found in the literature. Wykman and Goldie[23] obtained measures of postural sway through stabilometry in 21 patients with unilateral osteoarthritis. Sway patterns were recorded during 60-second time intervals on 3 different occasions: before THA, 6 months after surgery, and 12 months after surgery. The sway patterns, however, were recorded during bilateral stance. The results at 6 months postsurgery were highly variable with no consistent pattern or change in relation to presurgical sway pattern measures. Twelve months following surgery, measures of sway were significantly improved compared to presurgical measures. Because sway patterns were only recorded in bilateral stance, no involved to uninvolved limb comparisons could be made.

More recently, Ellison et al[3] compared Berg Balance Scale ratings in a group of patients approximately 6 months post-THA to a group of age- and gender-matched healthy subjects with no hip replacement. Scores on the Berg Balance Scale were not significantly different between the 2 groups. However, scores on a subset of 4 more difficult tasks from the Berg Balance Scale were significantly lower in the group of subjects with THA. The Berg Balance Scale is a tool used to assess balance that requires a rater to observe subjects' performance of 14 different tasks and to rate the performance on a scale of 0 to 4. The subset of 4 more difficult tasks selected from the Berg Balance Scale were the following: (1) turning to look behind while standing; (2) turning 360°; (3) placing each foot alternately on a step while standing unsupported; and (4) standing unsupported with one foot in front. Although the results of the study by Ellison et al[3] are important, there are potential confounding factors. Four different raters were used in this study, and intra- or interrater reliability was not determined. Reliability of the raters could be important because the 4 raters were physical therapy students who presumably had minimal experience in administering the Berg Balance Scale. Additionally, the raters were not masked to group assignment (THA or healthy). Ellison et al[3] did, however, establish a clear need to conduct further studies on postural stability in patients with THA.

Assuming a healthy central nervous system, one's ability to respond to sensory input is dependent on muscle strength and neuromuscular coordination. Studies by Fiatarone et al[4] and Lord et al[13] reveal that muscle strength affects postural stability and walking speed in older adults. In spite of the known relationship between lower-extremity muscle strength and postural stability, this relationship has not been studied in patients who have had THA. The purpose of this study was to determine whether impairments in postural stability, muscle strength, and range of motion (ROM) exist in patients who have had THA 12 months previously. Additionally, function was self-assessed as an outcome and relationships among self-assessed function, isometric muscle strength, and postural stability were determined.

METHODS

Subjects

A convenience sample of 15 subjects (11 women and 4 men) with a mean (± standard deviation) age of 62 ± 8 years was obtained for this study. The subjects ranged in age from 51 to 77 years and all were within 3 weeks of being exactly 12 months postsurgery at the time of their participation in this study. Fourteen of the subjects required THA as a result of osteoarthritis and 1 subject had osteonecrosis. Although a surgical approach was not specified as an inclusion criteria, all subjects who participated in this study had an anterolateral approach. Self-reported history of physical therapy revealed that all subjects received in-patient physical therapy after their surgery, followed by home health physical therapy that ranged from 1 to 6 weeks in duration. Two subjects received 1 week of additional therapy in an in-patient rehabilitation facility and 1 received outpatient physical therapy. Self-reported activity level revealed that 4 of the study subjects were currently participating in an aquatics program and only 1 subject had continued exercises taught by their physical

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therapist. All other subjects were not participating in any regular physical activity. Descriptive characteristics of subjects who participated in the study are presented in Table 1.

Volunteers for participation in this study were recruited consecutively from 3 orthopaedic practices in the Dallas, TX, area. To qualify for this study, subjects had to be at least 50 years of age and have had unilateral THA 12 months previously. Exclusion criteria were the following: (1) pain with weight bearing on either extremity; (2) hip revision surgery; (3) THA or other prosthetic implant in the opposite lower extremity; (4) diagnosed vestibular problems; (5) diagnosed central or peripheral nervous system involvement; and (6) dementia or decreased cognitive status that would affect ability to follow simple instructions. Potential subjects were screened for exclusion criteria through patient provided history. Screening for exclusion criteria was performed in a telephone interview prior to setting up an appointment for testing. All subjects who chose to participate, read and signed a consent form in compliance with the Institutional Review Board at Texas Woman's University.

Instrumentation

The 12-Item Hip Questionnaire[2] was used to self-assess physical function. This questionnaire pertains specifically to the functional ability of patients who have undergone THA. Therefore, construct validity and test-retest reliability have been determined in reference to the target population of the present study.[2] The 12-Item Hip Questionnaire is a self-administered paper and pencil exam whereby the patient rates pain or difficulty associated with performing a series of activities of daily living (ADL) on a scale of 1 to 5. The score on the questionnaire is a total score obtained by summing the ratings of each of the 12 items. The range of possible scores is from 12 to 60 with a low score indicating a high level of function.

Measures of hip ROM in the sagittal, frontal, and transverse planes were obtained using a 30-cm (12-in) universal goniometer. Lower-extremity muscle strength and postural stability were measured using the Human Performance Measurement (HPM) system (Human Performance Measurement, Inc, Arlington, TX). The HPM is a computer-automated system that integrates a battery of tests used to evaluate a broad range of sensorimotor functions.[17] The BEP IV and BEP IIIa are components of the HPM system that were used in this study to measure postural stability and muscle strength, respectively. The BEP for Windows™ software was used to operate the BEP modules and to record and store data.

The BEP IV postural stability measurement system uses a lightweight, portable force platform to measure medial-lateral stability, anterior-posterior stability, and total stability by tracking changes in the center of pressure (COP) over time as the subject stands erect over one foot or both feet. The face validity of using force plate measures of COP changes as an index of postural steadiness has previously been demonstrated.[7] To measure postural stability in single stance, the BEP IV samples COP movement at a rate of 60 samples per second over a 10-second time period. The resulting samples were then averaged over time and normalized for base of support by calculating the ratio of average movement of the COP to the size and placement of the stance foot. The resulting normalized score represents a "percent instability" score. This score was then subtracted from 100% to provide the score of percent stability used for data analysis. Four separate measures were obtained on the force platform to quantify postural stability (anterior-posterior stability, medial-lateral stability,

TABLE 1. Descriptive characteristics of study subjects.

Subject No.	Age (y)	Sex	Height (cm)	Weight (kg)	Type of fixation
1	66	F	175	85.0	hybrid*
2	67	F	163	78.8	cementless
3	51	F	157	71.8	hybrid
4	76	M	173	70.9	unknown
5	77	F	168	82.3	hybrid
6	53	F	163	81.8	cementless
7	61	F	163	86.4	hybrid
8	61	F	175	113.6	cementless
9	70	F	165	86.4	cemented
10	69	M	170	88.6	cementless
11	55	M	170	91.8	cementless
12	62	F	155	72.7	cementless
13	58	M	193	109.1	cementless
14	53	F	173	68.2	cementless
15	55	F	161	55.9	cementless
Mean ± SD	62.3 ± 8.3		168.2 ± 9.3	82.8 ± 14.9	

* One component was cemented; the other was press-fit (cementless).

total stability, and endurance). Endurance was measured as the amount of time the subject was able to maintain single stance, with 10 seconds being the maximum amount of time measured. All data reduction was performed using the BEP for Windows™ software.

The BEP IIIa was used to measure maximal isometric force produced by muscles surrounding each hip joint. The device was factory calibrated with respect to gain and instrumentation and has a gain accuracy of 1% of full scale. An offset calibration check was automatically performed each time the system was powered up. Muscle torque in newton meters (Nm) was calculated by the BEP for Windows™ software using estimated segment lengths that are based on each subject's height. The standard error associated with estimated segment lengths that are based on stature has previously been shown to be approximately 1.0 cm when compared to measured segment lengths.[21] The intrarater reliability of the BEP IIIa for measurement of muscle strength in patients with THA was assessed in this study in a subset of 7 subjects (14 limbs). The criterion validity of hand-held dynamometers as a measurement of muscle strength has been previously determined.[19,20]

Procedures

All data collection was performed by the same tester and required 1 testing session per subject. The tester was an experienced physical therapist with 9 years of practice using hand-held dynamometry. During the testing sessions, measures of function, postural stability, muscle strength, and ROM were obtained from each subject.

After reading and signing the consent form, subjects were first asked to complete the 12-Item Hip Questionnaire. Measures of postural stability, muscle strength, and ROM were obtained next on both lower extremities. All subjects had only one involved hip and the tester was masked as to which hip was involved. The order of testing, right or left side first, was determined randomly by selecting from a hat for the first subject, and alternating sides from that point forward for each subsequent subject. This form of randomization was used because the tester did not know whether the right or left hip was involved, and this method ensured that an equal number of right and left hips were tested first.

Postural stability was assessed in single-leg stance with the eyes open using the BEP IV force platform (Figure). Stability was assessed in each leg as subjects attempted to stand steadily on one barefoot extremity while holding the opposite leg in 0° of hip extension and 90° of knee flexion. The tester instructed subjects to first step onto the force platform, stand on both feet, and look straight ahead until an audible beep from the HPM system signified the beginning of the test. Upon hearing the beep, subjects

FIGURE. Measures of postural stability in single-stance were obtained using the BEP IV force platform.

raised one foot off the platform by flexing the knee to 90° and removed their hands from the table in front of them. Subjects then attempted to maintain this single-stance posture as steadily as possible until a second beep was heard, signifying the end of the 10-second trial. The trial was terminated by the tester before the 10-second maximum if subjects lost their balance and had to touch down with a hand or foot. Three trials of postural stability were measured and the BEP for Windows™ software calculated mean percent stability using the 2 trials with the most similar values. When the timed trial had to be terminated early (less than 10 seconds), percent stability for that trial was based on the shorter period of time. Each subject was allowed 1 practice trial prior to the 3 test trials, and a 5-second rest was taken in between trials.

Muscle strength was measured next using the BEP IIIa force transducer. All muscle force measurements were taken in a gravity-lessened position, using a ''make'' test. To perform a make test, the examiner held the dynamometer steady while manually stabilizing the subject with the other hand. Instructions to the subjects were to gradually start pushing against the dynamometer and then to increase their force until they were pushing as hard as they could.

Muscle tests were performed in the following order in each lower extremity: hip flexors, hip extensors, hip abductors, knee extensors, and knee flexors. See Table 2 for a description of testing procedures used for each muscle group tested. As with tests for postural stability, subjects were given 1 practice trial prior to the test trials. The beginning of each strength trial was signaled by an audible beep. For each trial, subjects were instructed to gradually start pushing against the dynamometer when the beep was heard, and then to push as hard as possible until another beep signaled the end of the 5-second trial. A second trial was performed in the same manner after a brief (2- to 3-second) pause. The BEP for Windows™ software automatically calculated mean muscle torque values using the average of the two trials for each muscle tested.

Measures of hip ROM in the sagittal, frontal, and transverse planes were then obtained, using a plastic 30-cm universal goniometer. Hip flexion, abduction, and adduction were measured with the subject in the supine position. Hip extension was measured in sidelying, and internal/external rotation was measured in the seated position with the hip and knee flexed 90°. Two trials were performed for each motion, and the calculated mean of the two trials was used for data analysis.

Data Analysis

Data were analyzed using the 9.0 version of SPSS for Windows (SPSS Inc, Chicago, IL). Test-retest reliability of strength measurements using the BEP IIIa was estimated by calculating intraclass correlation coefficients ($ICC_{3,1}$) on 7 randomly selected subjects. Because each physical impairment assessed in this study had many dependent variables (4 postural stability, 5 strength, and 6 ROM measures), 3 separate repeated measures MANOVA were used to analyze differences between the surgically replaced hip and the uninvolved hip. A MANOVA performed for groups of variables that are related helps to control for type I error when a large number of dependent variables is studied. A significant multivariate result was then followed with univariate ANOVA. A Spearman's rho was used to assess degree of association between the score of self-assessed function and impairments in strength and postural stability. An alpha level of 0.05 was used for all statistical tests of significance.

RESULTS

Reliability

The intrarater reliability ($ICC_{3,1}$) of strength measurements performed using the BEP IIIa dynamometer ranged from 0.85 to 0.97 for strength measurements in the 5 muscle groups on the side of the replaced hip. The calculated correlation coefficients ranged from 0.93 to 0.99 on the uninvolved side.

Descriptive Statistics

Table 3 presents means and standard deviations for ROM, strength, and postural stability measures on the involved and uninvolved sides.

TABLE 2. Muscle-testing procedures used for strength measurements using BEP IIIa hand-held dynamometer.

Muscle Group	Subject Position*	Tester Position	Force Transducer Placement
Hip flexors	Sidelying with test leg on top and supported by a pillow. Both legs in 90° hip and knee flexion.	In front of subject, facing the flexed hip and knee.	Distal aspect of anterior femur. Lower border of transducer 2.54 cm proximal to superior border of patella.
Hip extensors	Sidelying with test leg on top and supported by a pillow. Both hips extended and knees flexed 90°.	Behind subject, facing the extended hip.	Distal aspect of posterior femur. Lower border of transducer 2.54 cm proximal to the popliteal crease.
Hip abductors	Supine with the hip and knee in neutral flexion/extension and the hip abducted 20°.	Facing the subject, on the side of the leg to be tested.	Distal aspect of the lateral femur. Lower border of transducer 2.54 cm proximal to the lateral joint line of the knee.
Knee extensors	Sitting on the edge of a treatment table with the hip and knee flexed 90°.	At the level of the distal tibia facing the knee.	Distal aspect of the anterior tibia. Lower border of transducer 2.54 cm proximal to an imaginary line joining medial and lateral malleoli.
Knee flexors	Sitting on the edge of a treatment table with the hip and knee flexed 90°.	At the level of the distal tibia facing the knee.	Distal aspect of the posterior tibia. Lower border of transducer 2.54 cm proximal to an imaginary line joining the medial and lateral malleoli.

* For each muscle test, once subjects had assumed the test position, they were asked to grasp the table with their hands.

TABLE 3. Means (± standard deviations) for measures of postural stability, strength, and range of motion (ROM) on the side of the replaced hip and on the uninvolved side of the 15 subjects.

Outcome Measures	Replaced Hip	Uninvolved Hip
Postural Stability		
M/L* stability (%)	63.0 ± 32.3	88.9 ± 11.1
A/P† stability (%)	64.7 ± 32.5	91.8 ± 10.5
Total stability (%)	51.3 ± 36.8	82.8 ± 16.5
Endurance (s)	6.9 ± 3.3	9.7 ± 1.0
Strength (Nm)		
Hip flexors	34.2 ± 12.1	41.7 ± 13.9
Hip extensors	42.9 ± 10.8	47.6 ± 12.7
Hip abductors	41.2 ± 13.3	49.0 ± 14.3
Knee extensors	52.0 ± 17.6	59.4 ± 19.5
Knee flexors	45.1 ± 13.7	46.2 ± 14.3
ROM (°)		
Flexion	93.7 ± 18.7	95.7 ± 16.0
Extension	5.0 ± 10.4	5.0 ± 9.4
Abduction	23.9 ± 5.8	24.0 ± 8.1
Adduction	18.0 ± 6.1	19.0 ± 5.3
Internal rotation	24.1 ± 7.8	24.5 ± 7.8
External rotation	21.2 ± 5.1	22.5 ± 6.7

* Medial-lateral
† Anterior-posterior

Postural Stability

The repeated measures MANOVA revealed significant differences between the involved and uninvolved sides in measures of postural stability ($F_{4,11}$ = 3.7, P = 0.04). Repeated measures univariate ANOVA were then conducted to determine which postural-stability-dependent variables had significant differences between the involved and uninvolved sides. The ANOVA revealed that differences in all 4 postural-stability-dependent variables were statistically significant. Medial-lateral postural stability showed a mean difference of 25.9% ± 28.6% between the replaced hip and the uninvolved hip ($F_{1,14}$ = 12.3, P = 0.003). Mean differences between hips in values of anterior-posterior postural stability and total postural stability were 27.2% ± 30.6% ($F_{1,14}$ = 11.8, P = 0.004) and 31.5% ± 31.4% ($F_{1,14}$ = 15.0, P = 0.002), respectively. Mean difference between the involved hip and the uninvolved hip in measures of endurance during postural stability tests was 2.8 ± 3.2 seconds ($F_{1,14}$ = 11.2, P = 0.005). Mean paired differences between the involved and uninvolved sides in measures of postural stability are shown in Table 4.

ROM and Isometric Muscle Strength

Two separate repeated measures MANOVA calculated for ROM and muscle strength variables revealed no statistically significant difference between involved and uninvolved sides ($F_{6,7}$ = .48, P = 0.806) and ($F_{5,10}$ = 1.87, P = 0.186), respectively.

Self-Perceived Function

The median score on the hip questionnaire for the 15 subjects was 16, ranging from 12 to 35. A Spearman's rho was calculated as a measure of association between score on the hip questionnaire and impairments in postural stability and muscle strength. A measure of association between hip questionnaire score (HQS) and ROM impairment was not calculated because the majority of subjects did not have a ROM impairment. Impairment was calculated as the difference between measures on the uninvolved side and the corresponding measure on the side of the replaced hip. The Spearman's rho calculated for HQS and postural stability variables indicated a very weak association ($r < 0.25$). However, a moderate degree of relationship was found between the HQS and impairment in hip abductor (r = 0.56, P = 0.031) and knee extensor strength (r = 0.58, P = 0.031), respectively.

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TABLE 4. Results of data analysis for involved versus uninvolved sides for measures of postural stability, strength, and range of motion (ROM).

Outcome Measures	Mean Differences	F-Ratio	*P*-Value: MANOVA	*P*-Value: ANOVA
Postural Stability		3.7	0.040*	
M/L† stability (%)	25.9	12.3		0.003‡
A/P§ stability (%)	27.2	11.8		0.004‡
Total stability (%)	31.5	15.0		0.002‡
Endurance (s)	2.8	11.2		0.005‡
Strength (Nm)		1.87	0.186‖	
ROM (°)		0.48	0.806‖	

* Multivariate test significant at an alpha level of 0.05.
† M/L = medial-lateral
‡ ANOVA significant at an alpha level of 0.05.
§ A/P = anterior-posterior
‖ Multivariate test not significant at an alpha level of 0.05. ANOVA tests not conducted.

DISCUSSION

The most important finding of this study relates to the significant impairment in postural stability that exists 12 months after surgery for THA. Although clinicians often report that they observe postural stability problems in their patients who have had THA, this is the first study that provides objective evidence of impairment in postural stability on the side of the replaced hip when compared to the uninvolved side.

The reason for the impairment in postural stability is unclear but most likely involves multiple factors. The most obvious contribution to the loss in postural stability may be the assumed loss of joint proprioception as a result of the surgical procedure. However, in a study of 4 tasks of joint proprioception in subjects who had undergone THA, Stender and Drowatzky[18] reported no significant differences in performance of the tasks when compared with subjects who had healthy joints. Other studies comparing joint position sense between subjects' uninvolved hip and their surgically replaced hip have concluded that joint position sense remains intact after THA.[8,11]

Residual muscle strength deficits may contribute to impairment in postural stability. In the current study, strength deficits that ranged from 2.2% for the knee flexors to 18.0% for the hip flexors were not found to be statistically significant. The magnitude of the deficits, however, is consistent with deficits found in previous studies. Shih et al[15] studied 20 women and 20 men 1 year after they had undergone THA. These investigators measured isometric muscle strength in the hip flexors, extensors, and abductors, and found deficits ranging from 11% to 16% in the men and 19% to 21% in the women. Although these deficits only reached statistical significance for the hip flexors ($P < 0.05$), the investigators warned that any muscular weakness around the hip joint changes hip joint forces and can lead to joint instability. The authors also recommended that muscle-strengthening exercises be continued for at least 1 year after THA. Long et al[12] used force plate data to compare indirect measures of muscle strength on the side of the THA to the uninvolved side. The investigators concluded that the force plate data confirmed the persistence of muscle weakness 2 years following uncemented THA. Like Shih et al,[15] Long et al[12] recommended that a supervised exercise program be continued for a prolonged period of time to improve postsurgical muscle weakness. The authors did not define what they considered as ''prolonged.'' The degree to which muscle strength deficits influence postural stability is not known. Multiple studies have demonstrated a relationship between muscle strength and postural stability.[5,13,22] However, studies demonstrating a cause and effect relationship between muscle strength and postural stability are lacking.

The implications for the findings in the current study are important and should be confirmed in a larger sample size. One implication is that current exercise programs used during the acute phase of rehabilitation of patients with THA are not effective for restoring muscle strength and postural stability. Based on our findings, we suggest that patients with THA should continue their exercise program for at least a year or should be given a more advanced exercise program later in their recovery. We are currently studying the effects of an exercise program started 4–12 months postsurgery for THA on muscle strength and postural stability.

The moderate degree of association between scores of self-assessed function and hip abductor and knee extensor strength reveals that strength of these 2 muscles may be the most important factor in determining the patients' perception of their function. Additionally, previous studies have found significantly lower values of quadriceps strength in groups of fallers when compared to nonfallers.[5,22] Exercise programs for patients with THA should therefore address knee extensor strength in addition to strengthening of hip musculature. Although there was little or no association between scores of self-assessed function and postural stability in this study, observed impairments in postural stability have implications for fall risk[5] and should therefore be addressed in the rehabilitation of patients with THA. Judge et al[10] demonstrated that an exercise program consisting of resistance training, walking, and movements that emphasize postural control can improve postural stability in healthy older women; this has not been demonstrated specifically in patients who have had THA.

CONCLUSION

The brief postsurgical rehabilitation program received by patients with THA does restore ROM, but significant impairments in postural stability remain 1 year postsurgery. Although strength impairments were not statistically significant in our group of patients, the patients' perception of their level of function 1 year postsurgery appears to be related mainly to muscle strength in their hip abductors and knee extensors. Postural stability, though significantly impaired 1 year postsurgery, does not appear to be related to self-perception of function.

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