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Is There Faster Recovery With an Anterior or Anterolateral THA?

A Pilot Study

Virginia Klausmeier MS, Vipul Lugade MS, Brian A. Jewett MD, Dennis K. Collis MD, Li-Shan Chou PhD

Abstract Surgical technique is an important factor affecting recovery of hip function after total hip arthroplasty (THA). We therefore asked whether short-term recovery of hip strength and motion would differ between the anterior and anterolateral THA approaches. We presumed that although both approaches would improve hip function by 16 weeks postsurgery when compared with presurgery, a slower recovery would be demonstrated by the anterolateral group at 6 weeks when compared with the anterior group as a result of division and reattachment of the abductor muscles. We observed hip kinematics and kinetics during walking and isometric hip abductor strength for the involved limb. Hip abductor strength of all patients was lower than controls at all three testing times. Compared with presurgery, all patients demonstrated improved abductor strength at 16 weeks postsurgery. At 6 weeks, the patients with an anterior approach had improved late stance peak abductor moment postsurgery and reached the level of controls, but those with an anterolateral approach did not. Although the anterior approach was associated with improved gait velocity and peak flexor moments at 6 weeks compared to before surgery, we observed no differences between the two approaches for most of the isometric strength and dynamic gait measures at 6 or 16 weeks. Neither approach provided faster recovery.

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Each author certifies that his or her institution has approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.
This work was performed at Sacred Heart Medical Center, Slocum Center and at the University of Oregon, Eugene, OR, USA.

V. Klausmeier, V. Lugade, L.-S. Chou (✉)
Motion Analysis Laboratory, Department of Human Physiology, University of Oregon, 1240 University of Oregon, Eugene, OR 97403, USA
e-mail: chou@uoregon.edu

B. A. Jewett, D. K. Collis
Slocum Center, Eugene, OR, USA

Introduction

Many factors, including patient fitness level, comorbidities, and surgical procedure, contribute to a successful surgery. The surgical technique used during THA that allows patients to more quickly recover hip strength and mobility is unknown. The surgical approach is reportedly an important factor influencing THA stability and postsurgical abductor functioning [2, 14].

During the anterolateral approach THA, incisions are centered over the trochanter directly lateral in the tensor fascia latae. The anterior one-third of the gluteus medius and minimus tendons are detached from the trochanter to allow for femoral dislocation and adequate exposure to the joint [6, 9, 18]. A capsulectomy is performed and at closure, the gluteus medius and minimus tendons are repaired to their insertions. This approach allows proper exposure, implant positioning, and leg length correction [6]. However, lack of complete abductor muscle healing during this approach has been associated with occasional hip dislocation and the development of a limp [14].

In the anterior approach, the incision is made distal and lateral to the anterosuperior iliac spine and directed slightly anterior toward the greater trochanter. To access the hip, a fracture table and C-arm were used to expose the insertion site and ensure positioning of the components. A dissection is made under the medial aspect of the tensor fascia lata with the sartorius and rectus femoris retracted medially [15]; the abductor muscles are not detached [10, 15]. The anterior approach reportedly is associated with a low dislocation rate [22]. Given the difference in treatment of the tendons, we wondered whether there would be short-term functional gait differences in the hip abductor strength and gait performance between patients having the anterior and anterolateral THA at 6 and 16 weeks postsurgery.

We therefore determined whether (1) all preoperative patients undergoing THA would have decreased hip strength during isometric hip abduction and diminished hip kinematics and kinetics in all three planes during gait compared with control subjects; (2) at 6 weeks postsurgery, the patients undergoing anterior THA would have a more rapid return toward control levels for hip strength and mobility when compared with the patients undergoing anterolateral THA; (3) at 16 weeks postsurgery, no differences would be seen between patient groups for hip strength during isometric and gait activity; and (4) at 16 weeks postsurgery, patients would have similar hip abductor strength and gait performance compared with controls.

Patients and Methods

We recruited 33 patients, including 10 control adults and 23 patients undergoing THA, to participate. Patients undergoing THA had either an anterolateral (11 patients) or anterior (12 patients) approach (Table 1). Patient recruits were selected from the practices of two joint replacement surgeons, the anterolateral group from one surgeon (DKC) who has been exclusively using the approach for 30 years (3000 primary hips) and the anterior approach from the other joint replacement surgeon's practice (BAJ) who had exclusively used that approach for primary total hips for 3 years (300 hips). Patients were recruited from the Slocum Center (Eugene, OR) between March 2005 and April 2008 and were all patients with unilateral osteoarthritis between 45 and 70 years of age. THA subjects had no prior joint surgery or fracture on any lower limbs, any diagnosis other than primary unilateral hip osteoarthritis in the lower limb without predisposing causes, or any neurologic disabilities. The recruitment took 3 years to identify patients who fit into the study criteria and had time to participate in the study. We used the Harris hip scores [7] to indicate the level of function impairment before surgery for patients undergoing THA (Table 1). Age-matched control subjects were recruited at the University of Oregon campus and its surrounding community. Control subjects had no history of major head trauma or neurologic disorder, any visual impairment not correctable with lenses, any musculoskeletal impairments, or persistent symptoms of vertigo, lightheadedness, unsteadiness, falling, arthritis, or hip impairment. Before testing, all control subjects and patients agreed to the experimental procedure approved by the Institutional Review Board.

All patients had uncemented Zimmer hip implants, which included an acetabular component with an irradiated polyethylene liner (Trilogy Acetabular component; Zimmer Inc, Warsaw, IN) and femoral stem (Alloclassic SL Stem or Fiber Metal Taper; Zimmer Inc) and metal head component. All patients underwent the same rehabilitation

Table 1. Subject demographics [group mean (SD)]

Variable	Anterior	Anterolateral	Controls	95% Confidence interval
Gender (male:female)	8:4	9:2	5:5	NA
Age (years)	56.9 (3.3)	57.0 (7.3)	59.9 (5.3)	−3.4 to 9.2*
				−3.2 to 9.1†
				−5.7 to 5.9‡
Weight (kg)	92.8 (15.0)	95.7 (17.1)	74.7 (15.1)	−38.4 to −3.5*
				−35.2 to −0.9†
				−13.8 to 19.6‡
Height (cm)	170.4 (8.0)	175.0 (11.3)	168.1 (7.2)	−17.0 to 3.0*
				−12.1 to 7.4†
				−4.9 to 14.2‡
Body mass index (kg/m^2)	32.0 (5.1)	31.1 (4.1)	26.3 (3.9)	−10.2 to −0.1*
				−10.6 to −0.7†
				−5.3 to 4.3‡
Harris hip score	52.3 (12.7)	54.6 (12.7)	NA	−19.0 to 6.1‡

* 95% confidence interval (CI) of the difference between control subjects and anterolateral THA; †95% confidence interval of the difference between controls and anterior THA; ‡95% confidence interval of the difference between anterolateral and anterior THA; NA = not applicable.

protocol with a hospital therapist starting the day of surgery and being followed by the same outpatient therapist at 2, 6, and 16 weeks. We asked patients to begin weightbearing with crutches immediately after surgery with weightbearing on the operated extremity as tolerated. By 3 to 4 weeks postsurgery, patients switched to a cane and progressed to full weightbearing without assistive devices between 6 and 12 weeks postsurgery. Active abduction against gravity was started at 6 weeks postsurgery in both groups. By 16 weeks postsurgery, patients no longer used crutches for support and had resumed activities of daily living as a result of complete healing of the hip musculature. Muscle and gait testing for patients undergoing THA occurred at presurgery and 6 and 16 weeks postsurgery.

Control subjects were tested twice within 1 month to account for any interexaminer reliability (two examiners) or intrasubject repeatability. We performed isometric strength measurements to assess the maximum hip abductor strength of the involved limb for the THA subjects. Bilateral hip abductor strength was determined for the control subjects. We assessed isometric strength of the hip abductor with a KIN-COM dynamometer (Rehab World, Hixson, TN) during a standing position (0° of hip abduction), and the dynamometer was aligned so the axis of the lever arm coincided with the axis of rotation. We instructed subjects to push as hard as possible for a period of 5 seconds with a rest period of 30 seconds provided between repetitions. Each control subject or patient performed at least three trials to avoid any motor learning effects, and the average values were used for data analysis.

Control subjects and patients were then fitted with 29 retroreflective markers as described previously [5] and were instructed to walk barefoot along a 10-meter walkway at a self-selected speed. The starting position was adjusted for each individual to ensure a minimum of three steps were taken before reaching the data collecting area and a normal walking pattern was maintained while striking the force plates (Advanced Mechanical Technology, Inc, Newton, MA). We used an eight-camera motion analysis system (Motion Analysis Corp, Santa Rosa, CA) to collect a three-dimensional marker trajectory at 60 Hz. The motion data were low pass-filtered using a fourth-order Butterworth filter with a cutoff frequency of 8 Hz. The ground reaction forces of both feet were sampled at 960 Hz. The force data were time-synchronized to the video sampling to allow for computation of the joint moment using inverse dynamics.

We analyzed both gait temporal distance and joint kinematic and kinetic variables in this study. Gait temporal distance parameters included gait velocity, stride length, single-leg stance time, and step width. Stride length and step width were normalized to body height and anterior-superior iliac spine width, respectively, to account for anthropometric differences in subjects. Joint kinetic parameters included the peak hip abduction at early and late stance, internal and external rotation, and flexion and extension moments measured during the stance phase of the involved limb. We computed ROM of the hip in all three planes throughout the gait cycle. OrthoTrak kinematic analysis software (Motion Analysis Corp) was used to calculate the gait temporal distance, joint kinematics, and kinetic parameters.

Among the control subjects, group averages across two visits were used for comparison with the patient groups. To address our first question, we determined differences in the isometric hip abductor strength and hip joint kinematics and kinetics (ie, ROM and peak moments) in all three planes during gait between patient groups and control subjects at presurgery using a planned comparison (SPSS 14.0; SPSS Inc, Chicago, IL). For Questions 2 to 4, we examined differences across testing times and between patients and control subjects for the isometric hip abductor strength and three-dimensional hip ROM and peak moments during gait performance using a mixed model analysis of variance with repeated measures (SAS 9.1; SAS Institute Inc, Cary, NC). A mixed model analysis of variance was used to determine how our dependent variables changed both between and within groups [12].

Results

Before surgery, patients who were to undergo either an anterior or anterolateral approach demonstrated similarly reduced hip strength and gait performance when compared

Table 2. Presurgical comparison of hip joint kinetics between groups [group mean (SD)]

Hip moments (Nm/kg)	Anterior	Anterolateral	Control	p Value*,†
Isometric abductor	0.47	0.47	0.67	0.986*
	(0.12)	(0.10)	(0.12)	0.000†
Peak abductor at early stance	0.81	0.80	0.96	0.932*
	(0.25)	(0.11)	(0.18)	0.046†
Peak abductor at late stance	0.67	0.66	0.83	0.888*
	(0.22)	(0.10)	(0.13)	0.014†
Peak extensor	0.56	0.64	0.88	0.374*
	(0.25)	(0.23)	(0.23)	0.003†
Peak flexor	0.28	0.40	0.39	0.138*
	(0.16)	(0.23)	(0.16)	0.440†
Peak internal rotator	0.08	0.13	0.17	0.168*
	(0.06)	(0.08)	(0.09)	0.022†
Peak external rotator	0.22	0.12	0.27	0.054*
	(0.13)	(0.12)	(0.10)	0.027†

* Difference between anterior and anterolateral approach THA; †difference between patients and control subjects.

with control subjects (Table 2). Weaker isometric hip abductor strength, smaller hip ROM in the frontal and sagittal planes as well as smaller peak abductor and extensor moments were seen when compared with control subjects. Additionally, patients walked with a slower gait velocity, shorter stride length, and reduced single limb support time presurgery (Table 3).

At 6 weeks postoperatively, patients undergoing anterior THA did not demonstrate a more rapid return to control levels for hip strength and mobility when compared with the patients undergoing anterolateral THA. Although patients undergoing anterior THA demonstrated an increased gait velocity and stride length (Table 3), a greater sagittal plane hip ROM (Table 4), and a greater peak flexor moment during late stance (Table 5) when compared with presurgery, they did not demonstrate differences in a majority of the measures from the anterolateral THA group at this time period. We observed no pre- to 6-week postsurgical improvements in the patients undergoing anterolateral THA.

Table 3. Mean values (SD) for temporal distance gait variables.

Variable	Anterior THA	Anterolateral THA	Control	Group p values	Time p values
Gait velocity (m/s)					
Presurgery	0.96	1.09	1.29	0.193*	
	(0.27)	(0.25)	(0.17)		
6 weeks postsurgery	1.10	1.04		0.498*	0.010§
	(0.21)	(0.17)			0.394‖
16 weeks postsurgery	1.20	1.18		0.791*	< 0.001§
	(0.18)	(0.17)		0.227†	0.037‖
				0.156‡	
Stride length¶					
Presurgery	0.61	0.68	0.80	0.146*	
	(0.13)	(0.13)	(0.08)		
6 weeks postsurgery	0.69	0.63		0.131*	< 0.001§
	(0.07)	(0.12)			0.009‖
16 weeks postsurgery	0.73	0.72		0.642*	< 0.001§
	(0.07)	(0.08)		0.057†	0.108‖
				0.026‡	
Step width**					
Presurgery	0.44	0.43	0.34	0.835*	
	(0.11)	(0.13)	(0.06)		
6 weeks postsurgery	0.42	0.48		0.086*	0.294§
	(0.07)	(0.11)			0.069‖
16 weeks postsurgery	0.40	0.40		0.826*	0.374§
	(0.09)	(0.10)		0.160†	0.405‖
				0.245‡	
Single-leg support time (%)					
Presurgery	34.80	35.41	40.32	0.722*	
	(4.94)	(4.23)	(2.32)		
6 weeks postsurgery	37.72	38.42		0.603*	0.051§
	(2.50)	(4.38)			0.053‖
16 weeks postsurgery	38.64	38.23		0.766*	0.003§
	(1.96)	(4.44)		0.187†	0.028‖
				0.112‡	

* Difference between anterior and anterolateral approach THA; † difference between patients undergoing anterior THA and control subjects; ‡ difference between patients undergoing anterolateral THA and control subjects; § anterior THA difference from presurgery; ‖ anterolateral THA difference from presurgery; ¶ stride length was normalized to a person's body height; ** step width was normalized to a person's anterior-superior iliac spine width.

Table 4. Hip ROM during a gait cycle [group mean (SD)]

Variable	Anterior THA	Anterolateral THA	Control	Group p values	Time p values
Frontal plane					
Presurgery	6.33	8.02	13.63	0.421*	
	(3.63)	(2.67)	(5.56)		
6 weeks postsurgery	8.02	8.38		0.778*	0.323§
	(2.36)	(3.41)			0.834‖
16 weeks postsurgery	9.68	8.46		0.290*	0.054§
	(2.78)	(2.47)		0.004†	0.795‖
				< 0.001‡	
Sagittal plane					
Presurgery	23.53	30.89	48.33	0.069*	
	(8.58)	(12.01)	(6.62)		
6 weeks postsurgery	33.13	28.94		0.179*	< 0.001§
	(5.20)	(9.25)			0.323‖
16 weeks postsurgery	36.85	35.12		0.614*	< 0.001§
	(5.81)	(10.44)		< 0.001†	0.043‖
				< 0.001‡	
Transverse plane					
Presurgery	24.21	27.82	33.51	0.457*	
	(8.24)	(9.32)	(12.0)		
6 weeks postsurgery	29.87	30.85		0.851*	0.110§
	(13.76)	(9.94)			0.345‖
16 weeks postsurgery	26.63	28.92		0.525*	0.515§
	(8.55)	(8.14)		0.130†	0.704‖
				0.353‡	

* Difference between anterior and anterolateral approach THA; †difference between patients undergoing anterior THA and control subjects; ‡difference between patients undergoing anterolateral THA and control subjects; §anterior THA difference from presurgery; ‖anterolateral THA difference from presurgery.

By 16 weeks postsurgery, except for the peak external rotator moment, no differences were seen between the two patient groups for hip strength, hip mobility, or gait temporal distance measures. Continuous improvements in the patients undergoing anterior THA were apparent in gait velocity, stride length, and single-leg support time as well as the frontal and sagittal plane hip ROM when compared with presurgery (Tables 3, 4). We observed increased isometric hip abductor strengths with greater peak abductor (during late stance), extensor, flexor, and internal rotator moments (Table 5). Improvements in gait performance were also observed in the patients undergoing anterolateral THA at this time as compared with presurgery, including increased gait velocity, stride length, and single-leg support time. When compared with presurgery, the anterolateral group demonstrated a greater peak hip extensor moment by 16 weeks postsurgery. Although increases in the isometric hip abductor strength of the patients undergoing anterolateral THA were noticed between 6 and 16 weeks postsurgery, no differences were detected when compared with presurgery.

When compared with control subjects, both patient groups continued to demonstrate weaker isometric hip abductor strength at 16 weeks postsurgery (Fig. 1). Similar differences were noted for the peak abductor moment during early stance as well as ROM in the frontal and sagittal planes. The second peak hip abductor moment of the anterolateral group was lower at 16 weeks postsurgery compared with the control group, whereas the anterior group improved by 16 weeks postsurgery to reach the level of control subjects.

Discussion

Surgical technique is an important factor affecting recovery after THA. In this pilot study, we investigated short-term recovery of isometric hip strength and hip kinematics and

Table 5. Postsurgery peak hip moments in all three planes [group mean (SD)].

Variable	Anterior THA	Anterolateral THA	Control	Group p values	Time p values
Peak abductor moment at early stance (Nm/kg)					
6 weeks	0.79	0.73	0.96	0.362*	0.674§
	(0.21)	(0.14)	(0.18)		0.499‖
16 weeks	0.81	0.77		0.640*	0.311§
	(0.22)	(0.12)		0.017†	0.667‖
				0.006‡	
Peak abductor moment at late stance (Nm/kg)					
6 weeks	0.75	0.68	0.83	0.196*	0.070§
	(0.16)	(0.14)	(0.13)		0.839‖
16 weeks	0.76	0.69		0.143*	0.031§
	(0.13)	(0.09)		0.217†	0.456‖
				0.017‡	
Peak extensor moment (Nm/kg)					
6 weeks	0.70	0.55	0.88	0.225*	0.063§
	(0.32)	(0.27)	(0.23)		0.243‖
16 weeks	0.87	0.87		0.984*	0.001§
	(0.29)	(0.39)		0.718†	0.012‖
				0.743‡	
Peak flexor moment (Nm/kg)					
6 weeks	0.41	0.39	0.39	0.824*	0.012§
	(0.21)	(0.13)	(0.16)		0.849‖
16 weeks	0.40	0.49		0.326*	0.045§
	(0.23)	(0.21)		0.934†	0.129‖
				0.252‡	
Peak internal rotator moment (Nm/kg)					
6 weeks	0.10	0.04	0.17	0.613*	0.259§
	(0.07)	(0.17)	(0.09)		0.060‖
16 weeks	0.13	0.11		0.495*	0.012§
	(0.09)	(0.06)		0.190†	0.399‖
				0.053‡	
Peak external rotator moment (Nm/kg)					
6 weeks	0.22	0.12	0.27	0.027*	0.947§
	(0.08)	(0.11)	(0.10)		0.934‖
16 weeks	0.25	0.15		0.011*	0.413§
	(0.08)	(0.10)		0.544†	0.538‖
				0.004‡	

* Difference between anterior and anterolateral approach THA; †difference between patients undergoing anterior THA and control subjects; ‡difference between patients undergoing anterolateral THA and control subjects; §anterior THA difference from presurgery; ‖anterolateral THA difference from presurgery.

kinetics during gait for patients undergoing anterior or anterolateral THA. We presumed all patients would demonstrate weaker muscle strength and reduced gait performance at presurgery and believed patients with the anterior THA would show greater improvement by 6 weeks postsurgery when compared with the anterolateral group. Furthermore, by 16 weeks postsurgery, we presumed both surgical groups would be at a similar level as control subjects for muscle strength and gait activity.

There are a few limitations in this study. First, our patients were not randomly selected but rather enrolled based on their willingness to participate in the additional studies. Second, the treatments were not randomized and selection bias may have occurred by patients selecting

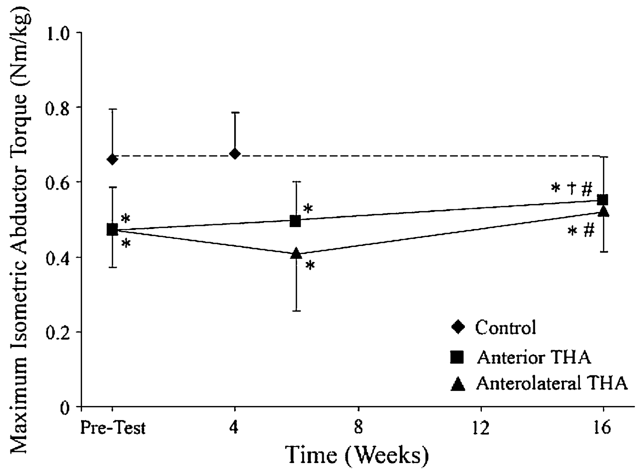

Fig. 1 Peak isometric hip abductor strength generated using the Kincom dynamometer for all groups across three visits is shown. *At presurgery, 6 weeks postsurgery, and 16 weeks postsurgery, the anterolateral ($p = 0.0007$, 0.0001, and 0.0043, respectively) and anterior ($p = 0.0005$, 0.0021, and 0.0270, respectively) THA groups had weaker abductor muscle strength than control subjects. Although we observed no observed between the two surgical approaches at any time point, the anterior group increased their muscle strength from presurgery to 16 weeks postsurgery ($^{\dagger}p = 0.0160$) and from 6 weeks postsurgery until 16 weeks postsurgery ($^{\#}p = 0.0028$). The anterolateral group had improved strength between 6 weeks and 16 weeks postsurgery ($^{\#}p < 0.0001$).

which physician to see. Although not randomized, patients included in this study represent typical demographics of a THA population reported previously [19, 20]. Third, the hip flexor strength that would be the most likely affected by the anterior approach was not examined. Although future work should investigate isometric hip flexor strength, our study did not find any differences in sagittal plane moments during gait among the two groups. Fourth, the study had a small sample size, which could hinder our detection of differences between groups. However, using the isometric hip abductor strength, a post hoc power analysis revealed an effect size of 1.6 and 94.6% power to detect group differences at the 0.05 alpha level for our 33 subjects. Such an effect size indicated patients were almost 1.6 SDs lower than the mean value of control subjects for hip abductor strength at presurgery [11]. An approximately one SD lower difference in isometric hip abductor strength is associated with a reduced distance walked in 6 minutes [24]. Finally, the two groups had similar demographics but inequality in gender distribution. Stature-related normalization was performed on the joint moments, however, to take into account individual anthropometric and gender differences.

Before surgery, diminished temporal distance gait parameters were demonstrated by patients undergoing THA when compared with control subjects. This is consistent with findings from previous studies [8, 21, 25]. Similarly, both patient groups also demonstrated weaker isometric hip abductor strength, smaller hip ROM, and peak moments during gait at presurgery when compared with control subjects. Past studies documented similar results among patients with hip osteoarthritis (Table 6) [3, 4, 17, 21, 23, 24].

We observed no differences between THA groups in temporal distance gait measures at 6 weeks postsurgery. Although the size of the incision and whether the muscle is cut during surgery reportedly have no influence on recovery of gait velocity by 6 weeks and 3 months postsurgery [26], our data suggest the anterior approach was associated with an improvement in gait velocity by 6 weeks postsurgery. No such pre- to postsurgery improvement was demonstrated by the anterolateral group. Furthermore, recovery of hip abductor isometric strength has been reported to be similar when comparing the posterior to the anterolateral approach [3]. We observed no differences between surgical approaches in the recovery of the hip abductor strength at any time point. However, the abductor strength of the patients undergoing anterior THA continuously increased postsurgery, whereas the patients undergoing anterolateral THA dropped below the preoperative level at 6 weeks postsurgery. This decrease in abductor strength among the anterolateral group could be the result of the partial detachment and repair of the gluteus medius during surgery [1]. Our results obtained from dynamic gait assessment concur with the trends obtained by the isometric muscle strength testing and are similar to previous studies [8, 21] with only the patients undergoing anterior THA in our study demonstrating normal magnitudes of the peak abductor moment (at late stance) at 6 and 16 weeks postsurgery.

When comparing THA approaches, by 16 weeks postsurgery, smaller external rotator moments were detected for the anterolateral THA group when compared with the anterior group. A decrease in rotational moments has been associated with THA, although the specific surgical approach has not been discriminated [8, 21]. The reduced external rotator moments could be the result of division and repair of the muscles at the hip during the anterolateral approach [6, 13]. However, this could also be the result of the preexisting deficiencies within the anterolateral group because neither patient group demonstrated a change in their peak external rotator moment after THA.

Although patients undergoing THA had approached the level of control subjects for gait velocity at 16 weeks postsurgery, there were still deficiencies in hip ROM and kinetics at 16 weeks postsurgery when compared with the control subjects. Recovery of hip function for our subjects could be indicative of residual antalgic gait in which patients are unable to restore hip strength and ROM [16].

Our data suggest the anterior and anterolateral approaches provide similar recovery after THA, although a

Table 6. Published hip kinetics from THA studies.

Study	Surgical approach	Followup	Isometric hip abductor strength (Nm)	Peak abductor moment at early stance (Nm/kg)	Peak abductor moment at late stance (Nm/kg)	Peak flexor moment (Nm/kg)	Peak extensor moment (Nm/kg)
Current study	Anterior	Presurgery	44.0 (10.5)	0.81 (0.25)	0.67 (0.22)	0.28 (0.16)	0.56 (0.25)
		6 weeks	45.5 (9.9)	0.79 (0.21)	0.75 (0.16)	0.41 (0.21)	0.70 (0.32)
		16 weeks	51.2 (10.7)	0.81 (0.22)	0.76 (0.13)	0.40 (0.23)	0.87 (0.29)
	Anterolateral	Presurgery	45.3 (9.5)	0.80 (0.11)	0.66 (0.10)	0.40 (0.23)	0.64 (0.23)
		6 weeks	39.1 (14.6)	0.73 (0.14)	0.68 (0.14)	0.39 (0.13)	0.55 (0.27)
		16 weeks	51.0 (10.8)	0.77 (0.12)	0.69 (0.09)	0.49 (0.21)	0.87 (0.39)
Downing et al. [3]	Lateral	Presurgery	73 N*	NA	NA	NA	NA
		3 months	94 N*				
		12 months	92 N*				
	Posterior	Presurgery	70 N*				
		3 months	83 N*				
		12 months	86 N*				
Foucher et al. [4]‡	Lateral and Posterior	Presurgery	NA	3.6 (1.1)†		1.7 (0.9)†	3.4 (1.3)†
		14 months		4.0 (0.9)†		2.6 (1.1)†	5.3 (1.7)†
Mont et al. [17]‡	Anterolateral	13 months	NA	0.45	0.50	0.40	0.60
Perron et al. [21]‡	NA	6–18 months	NA	1.10 (0.05)	1.15 (0.05)	0.45 (0.13)	0.40 (0.10)
Trudelle-Jackson et al. [23]	Anterolateral	12 months	41.2 (13.3)	NA	NA	NA	NA
Vaz et al. [24]‡	Direct lateral	Presurgery	39 (21)	NA	NA	NA	NA
		6 weeks	42 (19)				
		12 weeks	57 (21)				

* Data provided as a median value and in Newtons; †data provided as %BW*Ht; ‡data estimated from information provided in a figure; NA = not available.

greater subject pool might discriminate the two populations further. Short-term recovery of abductor function slightly favors the anterior approach at 6 weeks postsurgery, although both THA methods were similar when comparing muscle strength and hip function during gait by 16 weeks postsurgery.

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