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Original Research

'On Table' Versus 'Off Table' Direct Anterior Approach Total Hip Arthroplasty: Is There a Difference?

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ABSTRACT

Background: The purpose of this study was to evaluate whether there were differences in patient-reported outcomes, operative times, satisfaction scores, and complications between patients undergoing total hip arthroplasty (THA) performed through a direct anterior approach on a specialized traction table or a regular operating room table.

Methods: Patients who underwent a direct anterior approach THA on a specialized table or a regular table with a minimum 1-year follow-up were included. Patient-reported outcome measures and THA satisfaction were recorded. Demographics, complications, and operative times (both in-room and surgical time) were evaluated. Three hundred twenty-two patients were included with 217 (67.4%) undergoing anterior THA on the specialized table and 105 (32.6%) on a regular table.

Results: Outcome measures were similar at 4 months and 1 year postoperatively. Average operative time was 87 minutes (range, 50-160) and 90 minutes (range, 35-197) for the specialized table and regular table groups ($P = .314$). Average total in room time was 123 minutes (range, 87-201) and 120 minutes (range, 62-255) for the specialized table and regular table groups ($P = .564$). Satisfaction rates between groups did not differ ($P = .564$). No differences were found in complication rates at 4 months ($P = .814$) or 1 year ($P = .547$).

Conclusions: This study shows that the direct anterior approach for THA can be safely and efficiently performed on either a specialized traction table or a regular table. Surgeons should continue to utilize the approach and set-up they are most comfortable with to achieve an optimal outcome for the patient.

Introduction

The direct anterior approach has been described since the mid-1800s; however, its popularity has grown over the last 2 decades for use in total hip arthroplasty (THA) [1]. There is data to support that there is potentially less postoperative pain and earlier functional recovery with a direct anterior approach [2–8]. While this may be the case, which approach to use in primary THA has been extensively studied. Reliably, both the direct anterior and posterolateral approaches can be performed safely without any long-term functional or outcome difference [5,9–12].

Patients frequently request the anterior approach as they hope to achieve a faster recovery and a muscle-sparing approach [13]. The anterior approach utilizes a plane between the tensor fascia latae and the sartorius muscle, but unlike the posterior approach, it does not necessitate a split through the gluteus maximus muscle [14]. Thus, the marketing for the anterior approach has also increased significantly over the past 2 decades. Surgeons generally operate in the way in which they were trained to do so regarding approach and set-up. New techniques can also be learned in practice, as many surgeons have done so with the anterior approach [13]. Today, the direct anterior approach is widely used across the world for THA. While the anterior and posterior approaches differ in the placement of the incision and surgical technique, there can be differences in technique and set-up even when evaluating the

This study was performed at Scripps Clinic, La Jolla, CA, USA.

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anterior approach alone. With regard to the set-up for a direct anterior approach, 2 techniques exist: either on a specialized traction table ('on table') or a regular operating room (OR) table ('off table'). Which set-up to use is generally based on surgeon training, comfort level, and operating room equipment available. It can also be based on patient preference, provided the surgeon is comfortable with multiple approaches to performing a hip arthroplasty.

While the literature has focused on the differences between surgical approaches, there is a lack of studies comparing whether there are differences between the operative table used for the direct anterior approach at a single institution. The purpose of the present study was to evaluate if there were differences between the direct anterior approach THA performed on a specialized traction table vs a regular table as measured by operative time, complication rate, patient-reported outcomes, and satisfaction with the results of the THA. We hypothesize there will be no significant difference between tables for the above parameters.

Material and methods

This study was approved by the institutional review board prior to implementation of the study methods. All patients from January 1, 2018 to December 31, 2020 who underwent primary THA at a single institution with Current Procedural Terminology code 27130 were identified through archived records. Only patients who underwent THA through the direct anterior approach were included. One surgeon performed all anterior approach THA on the specialized traction table, and 2 separate surgeons performed all anterior approach THA on a regular OR table. While the direct anterior approach is all 3 surgeons' primary approach for THA, at times each surgeon may choose to utilize other approaches based on specific patient factors. Utilization of a different approach by these surgeons is reserved for patients necessitating conversion procedures or revision procedures. While there was no body mass index (BMI) cut-off, if a patient's body habitus would predispose to an increased chance of wound complication from a direct anterior approach, another approach may be chosen. Additionally, significant anatomic variations that would create a more complex primary operation including severe dysplasia, other acetabular deformity necessitating primary augmentation, or excessive heterotopic ossification were excluded from the study. Patients with less than 1-year postoperative follow-up were excluded. Patients who underwent THA for etiology other than primary osteoarthritis or osteonecrosis were excluded. Bilateral THA and THA performed for fractures were excluded.

All patients who met the above criteria were provided with a survey preoperatively and at their 4 month and 1-year postoperative follow-up visits, which included outcome measure and satisfaction questionnaire. The outcome measures utilized included the modified Harris hip score (MHHS), Patient-Reported Outcomes Measurement Information System (PROMIS), Hip Disability and Osteoarthritis Outcome Score Joint Replacement (HOOS JR). Postoperatively, the results of THA satisfaction were assessed using a five-point scale ranging from very dissatisfied to very satisfied.

Retrospective chart review was performed on study participants to gather patient demographics including age, sex, BMI, and comorbidity scale as measured by the Charlson comorbidity index (CCI). The CCI was evaluated retrospectively at the time of surgery. It is a weighted scale containing 17 comorbidities expressed as a sum and has been shown to be a validated predictor of postoperative function [15]. Other factors that were reviewed include in-room surgical time, operative time, complications (intraoperative and postoperative), and postoperative length of stay. A complication was defined to include intraoperative fractures, postoperative fractures or subsidences, dislocations, wound complications, infections, abscess, nerve injuries, or requiring revision surgeries. Survey responses were then matched to deidentified data. Data was then stored in a secure electronic database.

Statistical analyses included independent sample t-tests for 2 continuous variables and chi-square tests for categorical variables. Nonparametric tests (Mann-Whitney U test and Fisher's exact test) were used as needed. Demographics of both groups were compared to ensure there were no potentially confounding variables that would affect statistical analysis. Significance was set at $P < .05$, and all tests were two-tailed. The analysis was conducted using Statistical Package for the Social Sciences (SPSS) Statistics version 28 (IBM, Armonk, NY).

Basic demographics

Three hundred twenty-two patients were included in the study. All patients had a 1-year minimum postoperative follow up. Two hundred seventeen individuals (67.4%) had an anterior approach THA performed using a specialized traction table, and 105 individuals (32.6%) had an anterior approach THA performed on a regular table. There were no differences between sides of arthroplasty and which table was used ($P = .137$) (Table 1).

There were 166 women (51.6%) and 156 men (48.4%) included in the study. There were no differences seen between sex and the table used ($P = .788$). Mean age of all participants was 65.7 ± 9.8 years. No difference was found between age and which table was used ($P = .490$) (Table 1).

BMI was evaluated as recorded at the time closest to the surgical date. No difference was found between BMI and the table used ($P = .266$). Range of CCI was 0-9 with median value of 2. Mean CCI for all participants was 2.4 ± 1.3. No difference was found between CCI and the table used ($P = .440$) (Table 1).

Results

Primary outcome measures

Patients were evaluated with 3 outcome measures: MHHS, PROMIS Physical Function, and HOOS JR at 3 time points (preoperatively, 4 months postoperatively, and 1 year postoperatively).

MHHS (/91—increasing score is higher physical function): Mean score for specialized traction table patients preoperatively was 44.4 ± 1.1. Mean score for regular table patients preoperatively was 44.4 ± 1.6. Mean score at 4 months postoperatively was 75.3 ± 1.2 for specialized traction table and 75.9 ± 1.5 for regular table. Mean score at 1 year postoperatively was 82.4 ± 1.0 for specialized traction table and 78.8 ± 1.8 for regular table. No difference was seen at any time point between groups ($P = .808$, $P = .788$, $P = .069$) (Table 2).

PROMIS PF (/67.7—increasing score is higher physical function): Mean score for specialized traction table patients preoperatively was 43.0 ± 0.6. Mean score for regular table patients preoperatively

Table 1
Demographics.

	Table type			
Variable	Traction	Regular	Total	*P*-value
Patients	217 (67.4%)	105 (32.6%)	322	
Age (range)	66 (31-94)	66 (46-88)	57 (31-94)	.490
BMI (range)	25.7 (17.2-43.3)	26.2 (18.4-36.8)	25.8 (17.2-43.3)	.266
CCI	2.4 ± 1.4	2.3 ± 1.0	2.4 ± 1.3	.440
Sex				.788
Men	113 (52.2%)	53 (50.5%)	156 (48.4%)	
Women	104 (47.9%)	52 (49.5%)	166 (51.6%)	

Table 2
Outcome measures.

	Preoperatively			4 Month postoperatively			1 Year postoperatively		
	Traction table	Regular table	*P*-value	Traction table	Regular table	*P*-value	Traction table	Regular table	*P*-value
MHHS	44.4 ± 14.3	44.4 ± 13.9	.808	75.3 ± 14.2	75.9 ± 12.1	.788	82.4 ± 11.2	78.8 ± 14.0	.069
PROMIS PF	43.0 ± 7.2	42.1 ± 6.7	.369	53.7 ± 7.8	53.0 ± 8.0	.568	56.3 ± 7.4	55.3 ± 9.3	.718
HOOS JR	52.5 ± 12.4	51.4 ± 13.8	.449	81.6 ± 13.4	78.0 ± 11.6	.051	89.5 ± 12.2	85.6 ± 14.6	.077

All values are listed as mean ± SD.
MHHS, modified Harris hip score; PROMIS PF, Patient-Reported Outcomes Measurement Information System Physical Function; HOOS JR, Hip Disability and Osteoarthritis Outcome Score for Joint Replacement.

was 42.1 ± 0.8. Mean score at 4 months postoperatively was 53.7 ± 0.7 for specialized traction table and 53.0 ± 1.0 for regular table. Mean score at 1 year postoperatively was 56.3 ± 0.6 for specialized traction table and 55.3 ± 1.2 for regular table. No difference was seen at any time point between groups ($P = .369$, $P = .568$, $P = .718$) (Table 2).

HOOS JR (/100—increasing score is higher physical function): Mean score for specialized traction table patients preoperatively was 52.5 ± 1.0. Mean score for regular table patients preoperatively was 51.4 ± 1.6. Mean score at 4 months postoperatively was 81.6 ± 1.1 for specialized traction table and 78.0 ± 1.4 for regular table. Mean score at 1 year postoperatively was 89.5 ± 1.0 for specialized traction table and 85.6 ± 1.8 for regular table. No difference was seen at any time point between groups ($P = .449$, $P = .051$, $P = .077$) (Table 2).

Mean total room time in minutes for the specialized traction table was 123 minutes (range, 87-201) and 120 minutes (range, 62-255) for regular table. No difference was seen between the 2 groups ($P = .564$). Operative time in minutes for the specialized traction table was 87 minutes (range, 50-160) and 90 minutes (range, 35-197) for the regular table. No difference was seen between the 2 groups ($P = .314$).

Satisfaction questionnaire at 4 months demonstrated 9 individuals (6.6%) on the specialized traction table and 6 individuals (9.5%) on the regular table who were neutral or dissatisfied with their THA. There were 128 individuals (93.4%) on the specialized traction table and 57 (90.5%) on the regular table that were satisfied or very satisfied. No difference existed between the groups with regard to satisfaction after THA ($P = .564$).

There were 2 (0.9%) intraoperative complications in the specialized traction table group and 1 (1.0%) in the regular table group ($P = 1.0$). Up to 4 months postoperatively, there were 13 (6.0%) complications in the specialized traction table group and 7 (6.7%) in the regular table group ($P = .814$). New postoperative complications between 4 months and 1 year postoperatively included 1 (0.5%) in the specialized traction table group and 1 (1.0%) in the regular table group ($P = .547$). Specific complications for each group are detailed in Table 3. No difference in complication rate was seen at any postoperative point up to 1 year postoperatively.

Discussion

The popularity of the anterior approach has increased due to patient desires for more minimally invasive and muscle-sparing procedures [13]. New surgical tables and instruments have been specifically marketed to surgeons to increase the use of the direct anterior approach. The literature to this point has focused mainly on which approach is the safest for a THA and what complications occur as a result of the anterior approach. It is clear that any approach can provide an optimal outcome, but many studies have shown that the direct anterior approach may provide earlier functional recovery with lower initial pain [2–8]. This has led to both more patients and surgeons becoming invested in performing a THA through this approach.

Surgeons are trained to perform an anterior approach THA either on a specialized traction table or regular operating room table. Whether to perform the surgery ‘on table’ vs ‘off table’ is based on a variety of factors. Most commonly, it is the table they trained on in residency or fellowship, but it can also be due to institutional availability of a specialized traction table. A benefit of the specialized traction table is that it potentially provides easier manipulation of the extremity particularly for femoral exposure in larger or more muscular patients. While using intraoperative fluoroscopy, the legs are fixed in place, allowing for potentially more accurate implant placement. The specialized traction table does require another assistant available to manipulate the extremity during the operation, which may not be possible at certain institutions given staffing shortages or availability. The specialized traction table cost can be prohibitive at certain institutions as well, and the regular table does not have this start-up cost associated with it. Proponents of use of the regular table would also state that the set-up for the case is less cumbersome than needing to place the extremities in boots and into an appropriate position on the specialized traction table, with one less assistant needed for the surgery. Though these costs may be offset by the use of specialized drapes that are available for purchase for either set-up.

While these are the most commonly accepted benefits and limitations of both, this study aims to directly compare the anterior approach on a specialized traction table and regular table with regard to outcomes, satisfaction, complications, and operative time. At our institution, we have 3 surgeons that perform the anterior approach for THA, with one surgeon utilizing the specialized traction table and 2 surgeons utilizing the regular table. We hypothesized that there would be no difference in outcomes or complication rate between the use of the 2 different tables.

We used 3 different prospectively measured validated function scores over the course of 1 year postoperatively for both groups

Table 3
Complications.

Intraoperative complications	
Traction table	Regular OR table
Greater Trochanter fracture	Proximal femur fracture
Acetabulum fracture	
Postoperative complications - 4 mo	
Traction table	Regular OR table
Femoral subsidence (4)	LFCN palsy (2)
Wound complication (3)	Dislocation
Femoral fracture	Wound complication (4)
Lateral femoral cutaneous nerve (LFCN) palsy (3)	
Deep Vein Thrombosis (DVT) (2)	
Postoperative complications - 1 y	
Traction table	Regular OR table
Femoral subsidence	Heterotopic Ossification (requiring reoperation)

[16–18]. All groups had an increase in function score compared to preoperative levels at the 1-year mark for both the specialized traction table and regular table patients. There was no statistical difference for all 3 outcome measures (MHHS, PROMIS Physical Function, and HOOS JR) with regard to the specialized traction table or regular table. While this is a short-term measure over 1 year, it shows that both tables can be used with optimal functional achievement and increase with a THA, which is ultimately the goal of the operation. In that regard, at 4 months postoperatively, there was no difference in satisfaction rates for either table. A THA through any approach has been shown to provide extremely high satisfaction and the fact that both tables allow for this is a comforting measure for the surgeon to provide the standard of care for this operation.

Complications using the anterior approach are important to understand prior to performing THA on either table. Lee et al demonstrated through a systematic review that the most common complications after direct anterior approach THA include nerve dysfunction at 2.8% and intraoperative fracture at 2.3% [19]. The more cases that are completed by a surgeon, the more comfortable they become, and the complication rate decreases [20]. The most common nerve dysfunction through anterior approach is lateral femoral cutaneous injury. The mechanism of injury is related to the location of the skin incision and retraction of soft tissues during the procedure [19]. Femoral and peroneal nerve injuries, while possible, are much less common with this approach. The risk of femoral fracture is a result of potential limited visibility and learning curve of new approaches [19,20]. There is a purported initial advantage of decreased dislocation rate through anterior approach, though a large series Leichtle et al showed a dislocation rate of 1.1%, which is similar to rates of the anterior approach seen at 1.2% in the study by Lee et al [19,21]. In our study, there was no statistical difference in complication rate between the use of the 2 tables. No statistical difference was found again highlighting that both operations have similar complications and complication rates.

A concern with use of the specialized traction table is that the set-up takes more time than either on a regular table or even the posterior approach, as the patient's feet have to be placed in the boots and placed on the table. Sarraj et al performed a large comparative database study between the use of specialized traction table and regular OR table and found that outcomes and complications were similar between the groups, though operative time was shorter and there were less intraoperative fractures and blood loss with the use of a standard table [22]. This does differ from the results noted in the present study with regards to the operative time, as we found it to be similar between both groups. Their study is a much larger cohort of patients given the multiple studies incorporated through the database, but it is noted in their study as well the lack of studies with direct comparison between the 2 operating tables [22], which makes our study unique in this regard. Other single-surgeon studies have looked at the difference in operative time as well. Owen et al found shorter operative time for the regular table cohort [23], while Wernly et al did not find a difference in operative times or complications but did find leg length discrepancy improved in their regular OR table cohort [24]. As surgeons look to become more efficient to allow for the increasing demand for total joint arthroplasty, saving time with set-up and anesthesia is important to consider. We found that either approach can be utilized efficiently. It is important to note that the operating room staffs are critical to this effort. Having an efficient and specialized arthroplasty operating room staff can allow for faster turnaround times and set-up times.

A limitation of this study is the fact that it is not a single-surgeon study, and different surgeons utilized each table. The 2 surgeons who used the regular table used the same technique for the procedure. All 3 surgeons operate at the same facility and utilize the same perioperative protocols and operating room staff. All 3 surgeons are total joint arthroplasty-trained specialists with their practices consisting mainly of total knee and hip arthroplasty. It should be noted that the 'off table' volume was lower in the study period than the 'on table' in this study. It has been described that higher-volume hospitals performing THA may have lower cost and complication profiles compared to lower-volume institutions [25]. Our institution is a high-volume total joint center, and these 3 surgeons primarily use the direct anterior approach for THA, but at surgeon discretion, they will also use other approaches depending on necessity for specific patients. A portion of the study period was also during the COVID-19 pandemic, and this may have affected the study volume as well due to institutional shutdown and operative restrictions. The goal, though, is to show that the information provided in this study is generalizable to surgeons at other institutions, and we feel this is achieved by having no difference in outcomes despite evaluating different surgeons performing the same approach on different tables. Variability in the surgical times may also have been due to the study institution being a teaching facility. Trainees at different levels of training may contribute to increased surgical time during a case for teaching; however, this was true for both cohorts, and we still saw no statistical difference. While there are studies showing differences in operative time [22,23], the literature is still mixed in this regard [24]. Further studies are needed to evaluate longer-term outcomes directly comparing the use of both the specialized traction table and regular table, though short-term outcome was determined to be equivalent for use of either table.

Conclusions

The direct anterior approach for THA has become very popular among surgeons and patients. The study helps evaluate if there is any difference in several measures with regard to use of this approach on a specialized traction table or a regular operating room table. If a new approach needs to be learned while there is a learning curve associated to decrease complication rate, either table can be used for this purpose. This will sometimes be dictated by the limitations of the institution and whether a specialized traction table is available. We recommend orthopedic surgeons utilize this information to show that either table can be used safely and effectively for optimal outcome, especially in the short-term postoperative period, to improve a patient's quality of life with THA through a direct anterior approach.

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Conflicts of interest

J. Wilde is a paid consultant for DePuy. A. Kulidjian is a paid consultant, receives royalties from DePuy, and receives stock options from X40Tech. W. Bugbee receives royalties from Smith & Nephew; is a paid consultant for Arthrex, Inc, DePuy, Johnson & Johnson, Icarus Medical, Insight Medical, JRF Ortho, OrthAlign, Smith & Nephew; receives stock options from OrthAlign; receives financial support from JRF Ortho; is an editorial board member of Cartilage; is a board/committee member of the International Cartilage Repair Society. J. McCauley is a paid consultant for JRF Ortho. A. Narayanan receives financial support from Scripps Clinic Medical Group; the other author declares no potential conflicts of interest.

For full disclosure statements refer to https://doi.org/10.1016/j.artd.2023.101283.

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