Functional Outcomes of Direct Anterior Approach and Mini-Posterior Approach for Total Hip Arthroplasty

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Introduction: Primary total hip arthroplasty (THA) can reliably alleviate pain, improve function, and improve the quality of life in a broad segment of patients with end stage hip arthrosis. Recently, tissue sparing approaches have been devised with a goal of decreasing perioperative pain and speeding post-operative function compared with standard THA. Many tissue sparing approaches have been introduced in the past decade and each has reported advantages and disadvantages, with significant controversy in the orthopedic literature [1-3]. The mini-posterior approach has been studied extensively with promising results [4]. Recently, the direct anterior approach has been gaining interest as a procedure to improve functional outcomes [5]. Therefore, the purpose of this study was to compare the functional results of the mini-posterior approach THA to the direct anterior approach through field based activity monitoring.

Methods: A prospective randomized clinical trial was conducted in a cohort of 52 patients (age 64 ± 10 years range 38-81; BMI 51 ± 9, range 36 - 90; 24 female/28 male) to compare the direct anterior approach (DAA) to the posterior approach (PA) for primary THA. There was no significant difference in age or BMI between the two groups. All procedures were performed by surgeons with a subspecialty interest in THA. Components were identical in both groups and included a hemispherical uncemented acetabular component (Pinnacle, DePuy), uncemented hydroxyapatite coated femoral stem (Corail, DePuy), and chrome cobalt femoral heads on highly cross-linked ultrahigh molecular weight polyethylene acetabular bearing surfaces (DePuy). All components were FDA approved. All patients came to the hospital on the day of their surgery, unless medical problems dictated earlier admission. Hospitalization of three nights was routine for these patients. The patients received one pre-operative dose and three post-operative doses of IV antibiotics separated by a 6 to 8 hour period. All patients received appropriate anti-coagulation for deep vein thrombosis prophylaxis. Both treatment groups had similar post-operative care. Structured physical therapy began the day after surgery and continued during hospitalization. A home therapy program was given to the patient although formal physical therapy was not continued on an outpatient basis.

The study focused on functional outcomes in the free-living environment. Field based activity measurements were collected using activity monitors (Actigraph GT3X+, Pensacola, FL). Patients wore the monitors on the waist, thigh, and bilateral ankles. Each monitor contained a tri-axial accelerometer (+/- 6g) sampled with a 12 bit A/D converter at 100 Hz. Patients wore the monitors for three days. Data was collected within two months immediately prior to the scheduled date of surgery, and at 2 weeks, 2 months, and one year after surgery. Prior to analysis, a fourth order low-pass digital filter with a 50 Hz
filter cut off frequency was applied to the triaxial raw signals. Custom algorithms were used to determine periods of static and dynamic activity throughout the day [6]. Static postures of lying, sitting, and standing were determined based on the orientation of the waist and thigh accelerometers in relation to the line of gravity. Dynamic movements were classified as walking, jogging, or stair climbing activity that exceeded the pre-defined accelerometer amplitude threshold. Step counts were calculated based on detection of peak accelerations of the bilateral ankles using adapted thresholds during the longest period of walking [7]. Data analysis was performed using a 2-factor repeated measures ANOVA with repeated measures on time. The dependent variables were the daily dynamic activity, total steps per day, and the gait entropy of the involved leg. Post-hoc comparisons were made using paired t-tests at each time interval. Statistical significance was set at p<0.05.

**Results:** Both groups were dynamically active for 14% of the day at baseline testing with no significant difference between the two groups (Figure 1). The amount of activity decreased at two weeks after surgery to 10% for the DAA and 8% for the PA, which was significantly different. The amount of activity increased at two months to the pre-operative level and remained at that level at one year, with no significant difference between the two groups.
The steps per day varied with the dynamic activity (Figure 2). At baseline, the subjects averaged 5300 steps per day. The amount of dynamic activity decreased at two weeks post-operative to 3500 steps/day for the DAA and 1600 steps/day for the PA, a significant difference between the two groups. At two months both groups increased their activity to 5800 steps/day which continued to increase at one year to 6000 steps/day. There was no significant difference between the two groups at two months and one year.
The gait entropy paralleled the dynamic activity (Figure 3). At baseline both groups had gait entropy of 0.92 and were not significantly different. The gait entropy decreased at two weeks post-operative to 0.72 for the DAA and 0.48 for the PA, which was significantly different. At two months the gait entropy had increased to 1.05 and further increased to 1.24 at one year. While there was no difference between the two groups at two months and one year, there was a significant increase in entropy from two months to one year.

**Discussion:** An important outcome of THA is recovery of physical functioning. This study demonstrates that physical activity increases after THA in patients with osteoarthritis. Further, this study demonstrates that patients receiving a DAA do not experience as great a decline in activity at 2 weeks postoperatively as the patients who have received a PA. A unique aspect of this study is that physical functioning was measured in the subject’s natural environment. Therefore, these results provide a more complete understanding of the recovery of physical functioning after THA. Interestingly, the amount of time that the subjects were active at one year post-op did not differ much from the pre-operative status. However, the movement quality did improve. The subjects walked about 700 more steps per day, an increase of 13%. Further, the gait entropy demonstrated a 35% increase which indicated that the subjects were performing much more complex movements in their free-living environment. In summary, postoperative recovery does not result in a more active lifestyle but in an improvement in body mobility following THA.

**Significance:** This study documents evidence-based accelerated functional outcomes in patients receiving the direct anterior surgical approach for primary THA. Financial burdens may be reduced with
accelerated post-operative care, since patients achieve independence earlier after surgery and do not require assisted living support.