



Radiographic Parameters Associated with Pain Following Total Hip and Surface Arthroplasty



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ABSTRACT

Pain following total hip arthroplasty (THA) and surface arthroplasty (SRA) remains a significant source of patient dissatisfaction. Two hundred twenty-four SRA and 196 THA patients completed a pain drawing questionnaire and postoperative radiographic measurements of component positioning were performed. In the SRA cohort, 11 of 21 patients (52%) with acetabular uncoverage of ≥ 5 mm versus 43 of 147 (29%) with acetabular uncoverage of ≤ 4.9 mm reported groin pain ($P=.03$). In the THA cohort, an increased distal-third canal fill ratio and a lower canal calcar ratio trended towards a higher incidence of thigh pain ($P=.10$ and $.06$), while a decreased mid-third canal fill ratio was associated with increased severity of thigh pain ($P=.04$). This study identifies associations between radiographic findings and pain following THA and SRA.

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Total hip arthroplasty (THA) has demonstrated excellent survivorship and low complication rates in the management of degenerative hip disease [1]. However, despite well-fixed and well-positioned components, patients may present with residual pain in the thigh or groin following their procedure. The reported incidence of persistent pain in the early years following THA is as high as 40% [2–7]. Numerous factors have been associated with the occurrence of thigh pain after the use of cementless femoral stem fixation, including age, gender, stem size, activity level, bone type, and length of follow-up [4,8–11]. Similarly, groin pain following THA is often multifactorial, but may be attributed to impingement of the neck against the metal socket or soft tissues, irritation of the iliopsoas tendon across the rim of the acetabular component, or even hypersensitivity in the setting of metallosis [4,12,13].

Persistent pain following surface arthroplasty also remains a relevant concern. While the role of surface arthroplasty (SRA) versus THA remains controversial [14], a number of potential advantages of SRA exist including bone preservation and a return to higher activity levels [5]. However, several studies have noted an increased incidence of groin pain following SRA versus THA [15–17]. Bartelt et al, in a retrospective review of patients who underwent THA with conventional bearing surfaces versus metal-on-metal SRA, reported an 18% incidence of groin pain in the SRA cohort versus 7% in the THA cohort [12].

Therefore, pain following both THA and SRA remains a significant concern and clear source of patient dissatisfaction. While several studies

have assessed the impact of stem design (cemented versus cementless; proximally coated versus fully coated) on the incidence of thigh pain [4,10,18–20], to our knowledge, few have attempted to delineate associations between radiographic findings of component alignment and position, and postoperative pain. While the etiology of pain following THA and SRA can clearly be multifactorial, elucidating potential radiographic predictive factors of postoperative pain could affect both surgical technique and implant design. Therefore, this study sought to determine whether specific radiographic findings were associated with postoperative groin and thigh pain following THA and SRA as reported by patients using pain-drawing assessments. We hypothesized that the absence of bone covering the anterior aspect of the acetabular component would be associated with groin pain in both the THA and SRA cohorts, while potential indicators of increased distal fixation of the femoral component in THA would be associated with worsened thigh pain.

Materials and Methods

This study was a prospective, IRB-approved investigation from two centers with experience performing both THA and SRA in young, active patients. Inclusion criteria for this study were 1) patients between the age of 18 and 60, 2) primary THA or SRA due to non-inflammatory arthritis (osteoarthritis, post-traumatic arthritis, avascular necrosis, or hip dysplasia), 3) increased activity level as defined by a pre-symptomatic University of California at Los Angeles (UCLA) score ≥ 6 [21], 4) at least one year of clinical and radiographic postoperative follow-up, and 5) use of a posterolateral surgical approach. All THAs were performed using one of three cementless, titanium, proximally

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coated and tapered stems (Synergy, Smith and Nephew Inc., Memphis, TN; Anthology, Smith and Nephew Inc., Memphis, TN; Versys Fiber Metal Taper, Zimmer Inc., Warsaw, IN) with cementless, hemispherical acetabular fixation. Each patient was deemed a good candidate for cementless femoral stem fixation at the surgeons' discretion based on preoperative radiographs demonstrating good bone quality and a proximal femoral anatomy suitable for a proximally coated, tapered stem. All SRAs were performed using the Birmingham Hip Resurfacing System (Smith and Nephew Inc., Memphis, TN) with cementless acetabular and cemented femoral fixation. Exclusion criteria were 1) a history of postoperative infection, fracture, dislocation, or revision to the operative hip, 2) extensive medical comorbidities (i.e. hypertension, renal failure, CAD, liver disease, sickle cell disease, inflammatory arthropathy, respiratory disease, cancer, etc.) which would limit their activity level following their hip arthroplasty, and 3) use of a metal-on-metal bearing THA. Each center queried their respective total joint repository to identify patients who met the inclusion criteria.

Potential participants were mailed a letter explaining the purpose of the study and asking them to complete a previously described pain-drawing questionnaire (Fig. 1) [4,22]. The questionnaire asks participants to identify whether or not they experienced pain, and to what level, in eight anatomical areas of interest: the groin, anterior thigh, lateral thigh, posterior thigh, buttock, lower back, trochanteric region, and the knee. Pain intensity was rated using a pain scale scored from 0 to 5, with 0 being "no pain," and 5 being "pain at night that wakes you up, or constant pain." The primary focus of our study was on the incidence of groin and thigh pain. Informed consent was considered implied if a completed questionnaire was returned to their respective center, after which the data were de-identified and sent to the coordinating center. In addition, the University of California at Los Angeles activity score was collected from each patient [21].

Anteroposterior (AP) and cross-table lateral radiographs performed at greater than 1 year postoperatively were analyzed by a single, independent observer blinded to the presence or absence of postoperative

Pain Drawing and Scales

Patient Name: _____

ALL QUESTIONS RELATE TO THE OPERATIVE SIDE – LEFT

- 1.) Please identify any area(s) where you are experiencing pain by placing a number in the box next to the area(s) on the diagram below. Use the scale below to identify your level of pain.

0 = No Pain

1 = Pain with extreme activity only (running, excessive walking, etc.)

2 = Pain with moderate activity or specific movements only (getting in/out of a chair or car; going up/down stairs)

3 = Pain with daily activities (bathing, getting dressed, going to bathroom, etc.)

4 = Pain at rest during the day

5 = Pain at night that wakes you up, or pain all the time

- 2.) For any areas on the diagram where you indicated having pain, please check one small box that best represents the frequency of this pain. (Daily, Weekly, or Monthly)

The diagram consists of three human silhouettes labeled FRONT, BACK, and SIDE. Each silhouette has several shaded regions representing anatomical areas of interest. Next to each region is a box for a pain level (0-5) and three checkboxes for frequency: Daily, Weekly, and Monthly.

- FRONT View:**
 - Groin: Pain level box, Daily , Weekly , Monthly
 - Anterior Thigh: Pain level box, Daily , Weekly , Monthly
 - Knee: Pain level box, Daily , Weekly , Monthly
- BACK View:**
 - Lower Back: Pain level box, Daily , Weekly , Monthly
 - Buttock: Pain level box, Daily , Weekly , Monthly
 - Posterior Thigh: Pain level box, Daily , Weekly , Monthly
- SIDE View:**
 - Trochanteric: Pain level box, Daily , Weekly , Monthly
 - Lateral Thigh: Pain level box, Daily , Weekly , Monthly

Fig. 1. The pain drawing questionnaire sent to potential study participants.

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