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## The Knee



## Younger patients have less severe radiographic disease and lower reported outcome scores than older patients undergoing total knee arthroplasty☆☆☆☆☆☆

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## ABSTRACT

**Background:** Total knee arthroplasty (TKA) has been successful for many younger patients, but some experience residual symptoms or dissatisfaction. We performed this study to assess the relationship between radiographic disease severity and patient demographic features on patient reported TKA outcome scores.

**Methods:** We compared 100 TKAs performed for 82 patients  $\leq 55$  years old with 100 gender-matched TKAs performed for 85 patients between 65 and 75 years old. These study cases represented 25% and 21%, respectively, of TKAs performed between January 2006 and June 2011. Radiographic disease severity was determined from preoperative weight bearing AP and lateral radiographs. Patient reported outcome instruments (SF-12, Knee Society function, and WOMAC) were assessed for all patients within six months before surgery and postoperatively at a mean of 20 months after TKA.

**Results:** Although younger patients had less mean articular cartilage loss ( $p < 0.01$ ), osteoarthritis severity ( $p < 0.01$ ), and Kellgren–Lawrence grade ( $p = 0.05$ ), they reported lower preoperative scores ( $p < 0.01$ ) exceeding the MCID for SF-12 mental health (8.3 points), WOMAC pain (12.1 points), and WOMAC physical function (6.9 points). While substantial improvement was noted, WOMAC pain scores remained lower than those reported by older TKA patients (11.5 points,  $p < 0.05$ ).

**Conclusion:** Younger patients with less severe radiographic arthritis experience significant improvement with TKA, but outcome scores do not match those attained by older patients with more severe radiographic disease.

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☆☆ All authors confirm that the work involved in the accomplishment of this study is their original effort.

☆☆☆ Institutional Review Board Approval was Obtained Prior to Completion of this Study.

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## 1. Introduction

Primary total knee arthroplasty (TKA) is performed for over 70,000 patients per year who are  $\leq 55$  years of age at the time of surgery. Projections from US census data and utilization trends in this patient population suggest that as many as 900,000 TKA procedures may be performed in this patient population by the year 2030 [14]. While the literature has generally reported favorable clinical outcomes for knee replacement surgery performed for patients  $\leq 55$  years of age, patients in this age-defined population are considered to be at a higher cumulative risk for revision surgery and potentially persistent pain postoperatively [9,12,20]. Understanding this patient group, including surgical indications and clinical outcomes is important to enhance long term outcomes and reduce the burden of revision TKA surgery.

Previous studies have noted that patients are not uniformly satisfied with the outcomes of total knee replacement procedures [1,16,18]. Bourne et al. reported that as many as 19% of their patients were not satisfied, with expectations not being met as the most common reason for patient dissatisfaction [1]. Noble et al. noted that only 75% of TKA patients were satisfied and 14% of patients were dissatisfied with their knee replacement [16]. Parvizi et al. have noted that patients younger than 60 years of age are likely to experience residual symptoms following their TKA [18]. Furthermore, patients with less severe radiographic disease may be more likely to experience persistent pain that causes them to seek additional medical treatment. Polkowski et al. have noted that as many as 50% of patients who present for assessment of a painful TKA with acceptable postoperative radiographs had only mild or moderate preoperative radiographic disease at the time of their primary TKA procedure [19]. While several published studies have suggested a relationship between preoperative malalignment and obesity on the progression of knee osteoarthritis and postoperative TKA clinical outcome scores, these studies have not specifically reported on the radiographic disease severity of patients related to patient age at the time of TKA surgery [4–6,8,11,22]. We performed this study to assess the radiographic disease severity of younger patients ( $\leq 55$  years old) at the time of TKA surgery and the relationship between radiographic disease severity, patient demographic features, and preoperative patient reported outcome measures.

Questions:

- 1) Is osteoarthritis severity greater in younger or older patients undergoing primary TKA?
- 2) Is the relationship between radiographic disease severity and patient reported outcome TKA scores different among younger and older TKA patients at the time of their TKA surgery?

## 2. Materials and methods

After obtaining Institutional Review Board approval, we performed this retrospective study to assess radiographic disease severity among younger TKA patients  $\leq 55$  years of age and a gender-matched cohort of older TKA patients between 65 and 75 years of age who underwent surgery between January 1, 2006 and June 30, 2011. An a priori power analysis indicated that 100 knees would be adequate to confirm a 20% difference in radiographic disease severity with a moderate effect size ( $d = 0.4$ ), with Power = 0.8, and a confidence level of 0.05. Patients were identified from an institutional joint replacement registry. Study inclusion criteria included a diagnosis of osteoarthritis, radiographic imaging studies of adequate quality to assess for the presence of either tibiofemoral subluxation or patellofemoral malalignment, and patient reported outcome scores (Knee Society function score, WOMAC pain score, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) physical function score, University of California Los Angeles (UCLA) activity score) reported within six months before surgery and at a minimum one year clinical follow-up (range 12 to 48 months). Patients were excluded from consideration if they underwent TKA for a diagnosis other than osteoarthritis, did not have adequate radiographs to allow assessment of radiographic disease severity and had not completed postoperative follow-up instruments. Patients were enrolled on a chronological basis by date of surgery until the target enrollment (100 TKAs) had been obtained. The study population consisted of 82 patients (100 TKAs), including 18 patients who had undergone simultaneous or staged bilateral TKA within the study interval. Over the period of study (January 1, 2006 to June 30, 2011), 328 patients (376 TKAs) underwent TKA for the treatment of osteoarthritis. The younger TKA patient study cohort (Group A) represented 25% of all younger TKA patients treated. Mean patient follow-up for the study cohort was 21.8 months (range 12 to 48 months). Using the same inclusion and exclusion criteria, we enrolled a gender-matched cohort of 100 consecutive TKAs performed for older patients between 65 and 75 years of age that had met the inclusion criteria. The age distinction was intentionally selected to create a clear separation in the expected preoperative activity levels among patients when considering their chronological age. This comparison study cohort (Group B), consisted of 85 patients, who had returned for follow-up at a mean of 18.4 months (range 12 to 48 months). During the study interval, 411 patients (473 knees) underwent primary TKA for a diagnosis of osteoarthritis. The comparison study cohort represented 21% of all older TKA patients. The selected study and comparison groups are representative of their respective total TKA populations with a 7.5% confidence interval (90% confidence level) or with a 10% confidence interval (95% confidence level).

Age, gender and body mass index (BMI) were assessed for both study patients and non-included patients. Patient-reported clinical outcome measures including SF-12 physical function, SF-12 mental function, Knee Society function score, WOMAC pain score, WOMAC stiffness score, and WOMAC physical function score were assessed within six months prior to surgery and at their most recent follow-up. Sixty-one younger TKA patients (74%) and sixty-one older TKA patients (71%) in the control cohort were female. The study cohort and the total population of younger TKA patients and non-included younger TKA patients were similar with respect to gender (74.1% vs 67.7% female,  $p = 0.23$ ), mean age (50.1 vs 50.0 years,  $p = 0.99$ ), and mean BMI (34.2 vs 33.0,  $p = 0.21$ ). Patients in the study cohort reported higher mean WOMAC physical function scores compared to non-included younger TKA patients (48.1 vs 43.0 points,  $p = 0.03$ ) and demonstrated a trend towards higher mean WOMAC

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