

Role of Patellofemoral Offset in Total Knee Arthroplasty: A Randomized Trial

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KEYWORDS

- Total knee arthroplasty • Patellofemoral joint • Subject outcome assessment
- Treatment outcome • Randomized controlled trial

KEY POINTS

- The current study sought to establish if restoration of the overall patellofemoral joint thickness resulted in improved pain scores and function following primary total knee arthroplasty (TKA).
- There were no differences between groups in anterior knee pain, Western Ontario and McMaster Universities Arthritis Index (WOMAC) scores, or Knee Injury and Osteoarthritis Outcome Score (KOOS) scores.
- Overall, patellofemoral compartment height restoration versus patellar height alone does not seem to significantly reduce pain or improve function following TKA.

INTRODUCTION

Patient satisfaction following total knee arthroplasty (TKA) is inconsistent and frequently does not meet the expectations of patients, with as few as 4% of patients rating themselves as “very happy” with their outcome, despite excellent survivorship.¹ Therefore, understanding the causes for this lack of satisfaction and improving patient-perceived outcomes is critical, not only to better meet patient expectations but also with the understanding that these patient-reported outcomes will be published and potentially tied to reimbursement in the near future.

Anterior knee pain is a major contributor to patient dissatisfaction following TKA and remains a largely unsolved problem. In a study by Meftah and colleagues,² one-third of all

TKA subjects experienced mild-to-moderate anterior knee pain at 1-year follow-up. This pain persisted in 30% of previously symptomatic subjects at 10 years, with 10% of previously asymptomatic subjects developing new onset anterior knee pain. Multiple technique and implant-related causes have been previously described, including instability, component rotation, component characteristics, and overstuffing of the patellofemoral joint.^{3–10} Anatomic considerations have also been examined. Kohl and colleagues¹¹ found no correlation between patellar blood flow and anterior knee pain following TKA. Additionally, attempts to curb anterior knee pain through circumpatellar electrocautery denervation have had variable results.^{12,13} Despite improvements in surgical

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techniques and advances in implant characteristics to more patellofemoral joint-friendly designs, anterior knee pain following TKA persists and largely remains an enigma.^{14,15}

The patellofemoral joint is composed of the patella and the corresponding anterior aspect of the distal femur with which it articulates. During TKA, the anterior aspect of the distal femur is resected flush with the anterior femoral cortex and resurfaced with the anterior flange of the femoral component. In instances of patellar resurfacing, the patella is resected and an implant placed on its cut surface. Current surgical techniques call for restoration of the patellar thickness by removing a depth of patellar bone that corresponds with patellar implant thickness. This technique, however, does not account for the amount of anterior distal femoral bone that is resected and replaced by the femoral component. As a result, an emphasis is placed on restoring patellar thickness but not necessarily restoring the overall thickness of the native patellofemoral joint. Because a wide variation in anterior condyle anatomy has been previously described, there is a high likelihood that the native patellofemoral joint height is not re-established during conventional TKA, either by overstuffing the patellofemoral joint or inadequately restoring the patellofemoral height.¹⁶ Such inaccuracy may adversely affect knee function by altering the native extensor mechanism and its moment arm, either by creating laxity in the case of overresection or by overtightening the extensor mechanism if underresected.^{17,18}

Because there is currently a lack of literature examining this issue, the authors pose the following research questions:

1. Does restoration of native overall patellofemoral height reduce pain following primary TKA?
2. Does restoration of native overall patellofemoral height improve function following primary TKA?

SUBJECTS AND METHODS

Subject Selection

Following institutional review board approval, a cohort of consecutive subjects undergoing elective primary TKA was prospectively randomized to either the experimental or control group. All patients presenting for primary TKA who had failed conservative management were included as study candidates. Patients were excluded if they were deemed candidates for unicompartmental knee arthroplasty, were undergoing

revision TKA, had preoperative angular deformities of greater than 15°, had patellar subluxation or dislocation on history or clinical or radiographic examination, or had severe patellar bone loss as determined by the operating surgeon. Clinical coordinators collected study data during preoperative and postoperative clinic visits. A random-number generator was used to randomize subjects to either the control group or experimental group in a 1 to 1 fashion. Subjects and clinical coordinators were blinded as to the group assignment. The performing statistician was also blinded to the groups.

Assuming an estimated anterior knee pain visual analog score (VAS) of 15 in the control group and a VAS pain score of 5 in the experimental group, a 1-sided t-test assuming equal variance (standard deviation of 10 points) with an effect size Cohen's *d* of 1.0, and an alpha level of 0.05, an estimated 23 subjects were needed in each group for 90% power. Allowing for a 15% lost to follow-up rate, 26 subjects were enrolled into each group for a total of 52 subjects.

Forty-six subjects completed the study with at least 1 year of follow-up and were included in the analysis. Six subjects initially enrolled were excluded from analysis, including 2 subjects in group I and 1 subject in group II who did not return for their 1-year evaluation. An additional 2 subjects in group I were excluded from analysis because the patella was deemed to be too thin by the operating surgeon at the time of surgery to safely perform the patellar resection as required by the study. One subject in group II was excluded due to failure from infection before 1-year follow-up.

The final dataset consists of 22 subjects in group I, which includes of 15 women and 7 men. Group II was composed of 24 subjects, with 20 women and 4 men. The mean age of group I was 67 years (range, 50–78 years) with a mean age of 69 years in group II (range, 54–82 years). There were no statistical differences between groups in the demographic characteristics of the study subjects. The demographic data for each group are reported in [Table 1](#).

Subjects in both groups underwent cemented, posterior stabilized, TKA performed through a standard medial parapatellar arthrotomy using gap-balancing technique by 1 of 2 fellowship-trained arthroplasty surgeons (Springer BD, Fehring TK). All patellae were resurfaced and a tourniquet was used in every case, inflated before incision, and released after curing of all cement. Primary total knee components from 2 different manufacturers (DePuy, Warsaw, IN, USA; and,

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