Does Knee Osteoarthritis Affect The Femoral Component Position During Total Hip Arthroplasty? 3D Model Analysis

Kwang Woo Nam1,2, Dimitris C. Dimitriou2, Tsung-Yuan Tsai, Ph.D.2, Jing-Sheng Li2, Kwan-Kyu Park, M.D.2, Harry E. Rubash, M.D. & Ph.D.2, Guoan Li, Ph.D.2, Young-Min Kwon, M.D. & Ph.D.2.
1Jeju National University School of Medicine, Jeju, Korea, Republic of, 2Massachusetts General Hospital/Harvard Medical School, Boston, MA, USA.

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Introduction: There is an increasing number of the patients in the world with both hip and knee osteoarthritis that require surgery. Precise component placement is known to be a prerequisite for successful total hip arthroplasty, as component malposition is related to aseptic loosening, impingement, dislocation and eventually, implant failure. The safe zone for combined anteversion of cup and stem to avoid impingement and dislocation has been reported to be 30° ~ 60°. The severity of knee osteoarthritis could influence the femoral stem anteversion. There is limited data on the femoral stem placement accuracy using postoperative computed tomography with diverse results on femoral anteversion differences ranging from 1° to 25°. However, the potential influence of knee osteoarthritis on the femoral stem placement has not been previously reported. The purpose of this study is to identify the femoral anteversion difference between native and prosthetic femur and to evaluate the effect of the grade of knee osteoarthritis on that difference.

Methods: Preoperative and postoperative 3D models using computed tomography were reconstructed for 20 femurs of 16 patients underwent primary cementless THA with tapered femoral stems. On the preoperative computed tomographic images and scout films, the grade of knee osteoarthritis was classified into four grades adopting Kellgren-Lawrence classification (Fig. 1). The differences of proximal femoral parameters between preoperative and postoperative femur were compared, including femoral head anteversion, femoral neck anteversion, neck-shaft angle, horizontal and vertical offset, hip joint center, and height. At each level, the mid-cortical line was defined as the middle between anterior and posterior cortical line using best-fit circle model (Fig. 2). Pearson correlation analyses was used to investigate the significant relationship between knee osteoarthritis grades and femoral head and neck anteversion differences. Multiple linear regression analysis adjusted for other variables was performed to find significant factors influencing the femoral anteversion differences.

Results: The average and standard deviation values for preoperative femoral head anteversion, preoperative femoral neck anteversion, postoperative prosthetic head anteversion, and postoperative prosthetic neck anteversion was 14.4°±8.9°, 15.9°±10.1°, 9.4°±9.4°, and -2.3°±5.9°, respectively. There were significant differences between preoperative and postoperative head and neck anteverions of 5.0°±14.6° and 18.2°±11.9, respectively. The distribution of knee osteoarthritis among the patients was: grade 1: 5 cases, grade 2: 7, grade 3: 4, and grade 4: 4 cases. There were significant correlation between knee osteoarthritis grades and head or neck anteversion differences (p=0.001, p=0.000, respectively).
Knee osteoarthritis grade was found to be an independent influencing factor on head and neck anteversion differences after multivariate analyses (p=0.001, 95% CI: 4.18~14.39; p=0.000, 95% CI: 7.63~12.52, respectively).

Discussion: The results of the current study demonstrate that increased femoral stem anteversion during total hip arthroplasty is correlated with the presence of severe knee osteoarthritis. This phenomenon may be due to the fact that it is difficult to place tibia vertically to estimate femoral anteversion intraoperatively when there is a flexion contracture or varus deformity secondary to the knee osteoarthritis. This data suggests that surgeons may need to examine the knee osteoarthritis to optimize the femoral component anteversion during total hip arthroplasty.

Significance: Surgeons should examine the knee osteoarthritis to optimize the femoral component position in total hip arthroplasty.

![Kellgren-Lawrence classification](image)

**Figure 1.** Kellgren-Lawrence classification.

![Femoral head anteversion difference](image)

**Figure 2.** A. Femoral head anteversion difference between native and prosthetic femur. B. Femoral neck anteversion difference (yellow arrow: native, red arrow: prosthetic)