

# How Do Changes in Femoral Anteversion Impact Femoral Rotation and Anterior Offset following Total Hip Arthroplasty?

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## INTRODUCTION:

The impact of femoral anteversion changes on femoral rotation and anterior offset following total hip arthroplasty (THA) have not been well studied. This study investigated the relationship between femoral anteversion, anterior offset, and femoral rotation before and after THA.

## METHODS:

A total of 1,095 patients with staged primary bilateral THAs received a preoperative supine CT scan, following a standardized protocol, for surgical planning prior to each THA. The following measurements were performed for the first operative hip preoperatively and postoperatively on the first and second CT scans respectively: femoral anatomic anteversion, defined as the angle between the native femoral neck or stem neck axis and the posterior condylar axis; femoral rotation, defined as the angle of the posterior condylar axis relative the coronal plane of the CT; femoral anterior offset, defined as the shortest distance between the femoral head center and a femoral plane containing the epicondyles and the piriformis fossa. Mean time between imaging was 11 months (range 2-44). Associations are described using linear regression ( $\beta$  = slope) and Pearson correlation ( $r$ ) coefficients. A  $t$  distribution was used for testing correlation significance.

## RESULTS:

Femoral anatomic anteversion correlated with femoral anterior offset preoperatively ( $\beta=0.565$ ,  $r=0.914$ ,  $p<0.0001$ ) and postoperatively ( $\beta=0.671$ ,  $r=0.958$ ,  $p<0.0001$ ; Figure 1), and with femoral rotation preoperatively ( $\beta=0.623$ ,  $r=0.575$ ,  $p<0.0001$ ) and postoperatively ( $\beta=0.459$ ,  $r=0.517$ ,  $p<0.0001$ ; Figure 2). Increasing anteversion from preop to postop increased anterior offset ( $\beta=0.621$ ,  $r=0.908$ ,  $p<0.0001$ ) and femoral internal rotation ( $\beta=0.241$ ,  $r=0.273$ ,  $p<0.0001$ ; Figure 3). Patients with  $>20^\circ$  increase in anteversion (mean increase  $26^\circ$ , range  $20-40.5^\circ$ ,  $n=71$ ) had a mean increase in femoral internal rotation of  $9.6^\circ \pm 9.8^\circ$ .

## DISCUSSION AND CONCLUSION:

Increasing femoral anteversion increases anterior offset and femoral internal rotation, with approximately a  $1^\circ$  increase in internal rotation for every  $4^\circ$  increase in anteversion on average. Surgeons should appreciate the implications of changing anteversion intraoperatively during THA considering adaptive functional changes in dynamic femoral rotation.

Figure 1 – Femoral anterior offset vs anteversion

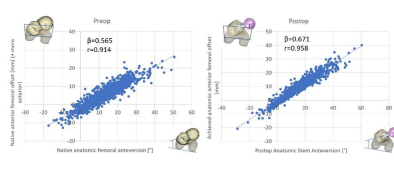


Figure 2 – Femoral rotation vs anteversion

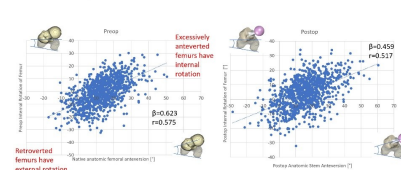


Figure 3 – Change in femoral anterior offset (left) and femoral rotation (right) vs change in femoral anteversion

