**OPTIMAL PLACEMENT OF THE FEMORAL COMPONENT TO AVOID NOTCHING OF THE FEMORAL NECK IN RESURFACING ARTHROPLASTY OF THE HIP**

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**Introduction:** Despite improvement in hip resurfacing technique, femoral neck fracture remains a major concern. In many cases, intraoperative notching of the neck and varus placement of the femoral component appear to predispose to neck fractures. To avoid these errors, surgeons have advocated anterior/superior displacement of the femoral component to reduce notching and valgus alignment to lower stresses on the neck. However, excessive valgus alignment can, in fact, lead to notching of the lateral neck and subsequent femoral fracture.

In this study, we examine the inter-relation of head shifting and valgus alignment of resurfacing prostheses by determining optimal placement of femoral components in three orientations with respect to the femur: 1) at a fixed valgus angle of 140°, 2) in 5° more valgus than the original neck axis, and 3) matching the orientation of the original neck axis.

**Materials and Methods:** Computer models of a standardized design of resurfacing arthroplasty were implanted in 3D models of 13 femora (average NSA=126º±3.3º). In each case, the femoral component was initially oriented in a fixed valgus angle of 140°, with its head size and head center exactly matching that of the original femur. In the lateral view, the implant was aligned to match the anteversion of the original femur (Figure 1).

Due to the small sample sizes, there were no significant differences between the 140° and NSA+5° successes in terms of required increase in head diameter (1.33±0.52mm vs. 1.00±0.00mm, p=0.17) or anterior displacement (1.53±1.22mm vs. 0.85±0.48mm, p=0.21). There was, however, a significant decrease in medial offset (140°: 1.96±0.81mm vs. NSA: 1.44±0.43mm, p=0.04).

**Results:** Examination of the femoral neck cross-section revealed that a custom-created implant in the ideal femoral group would only need to be shifted 0.24±1.34mm inferiorly and 0.15±1.73mm anteriorly to align the center of the component to the neck axis. Regardless of repositioning, a femoral component equal to the original subchondral head size could rarely be implanted without notching (0% in 140°; 15% in NSA and 15% in NSA+5°). Upsizing of the implant by 2mm increased the success rate to 100% for the neck axis group, 92% for the NSA+5°, and 60% at 140°. However, this necessitated displacement of the head center by an average of 0.90mm superiorly, 1.30mm anteriorly, and 1.77mm laterally. To accommodate the combination of repositioning and increased head size, the reamed diameter of the acetabulum also increased by an average of 2.72mm.

**Discussion:** Resurfacing of hips can be successfully performed when the implant is placed at moderately valgus angles, such as 5 degrees more valgus than the neck shaft angle. However, successful implantation does require increases in head size, as well as shifts in the head center anteriorly and laterally to avoid notching of the femoral neck.

Placement of the femoral component at 140 degrees of valgus carries a significant risk of notching of the neck, significantly decreases medial offset, and requires additional upsizing of the femoral head. The end result is a compromise of the original femoral offset and loss of bone stock on the acetabular side.