

## The Effect of Baseplate Version on Impingement Free Range of Motion in a Lateralized Glenoid and Inlay Humerus Reverse Shoulder Arthroplasty

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**INTRODUCTION:** Impingement free range of motion (IF-ROM) is an important determinant of functional outcomes after reverse shoulder arthroplasty (RSA). The purpose of this study was to evaluate the effect of baseplate version on IF-ROM using a lateralized glenoid and inlay humerus RSA system in shoulders without glenoid wear.

**METHODS:** 3-dimensional scapulohumeral models of 12 (7 male) patients with massive rotator cuff tears and normal glenoid morphology were used. Mean age was  $72.7 \pm 6.5$  years. Mean glenoid version was  $-8.2 \pm 4.1^\circ$ . The baseplate was positioned at the inferior edge of the glenoid with neutral inclination and version at  $-10^\circ$ ,  $0^\circ$ , and  $+10^\circ$  relative to native version. Small shell humeri were used in females and standard shells in males. 32-4 and 32N glenospheres were used. IF-ROM and impingement points were evaluated in external rotation (ER), internal rotation (IR), flexion, extension, adduction (ADD), and abduction (ABD) with the humerus in  $20^\circ$  and  $60^\circ$  ABD. Mixed effects models were used to assess the effect of version.

**RESULTS:**

### *IF-ROM*

**$20^\circ$  ABD:** Retroversion was associated with greater ER ( $p < 0.05$ ), and anteversion was associated with greater IR than native version ( $p < 0.0001$ ) for both glenospheres. For the 32-4 glenosphere, anteversion was associated with greater ADD than retroversion ( $p = 0.005$ ) but not native version. For the 32N glenosphere, native version was associated with greater ABD than anteversion ( $p = 0.014$ ) and retroversion ( $p = 0.001$ ). For the 32N glenosphere, anteversion was associated with greater ADD than native ( $p = 0.025$ ) and retroversion ( $p < 0.0001$ ). Anteversion ( $p = 0.046$ ) and native version ( $p < 0.0001$ ) were associated with greater ABD than retroversion.

**$60^\circ$  ABD:** Retroversion was associated with greater ER ( $p < 0.0001$ ) for both glenospheres. Anteversion was associated with greater IR than native version for the 32-4 ( $p = 0.034$ ) but not 32N.

### *Impingement 32-4 Glenosphere (Table 1)*

**$20^\circ$  ABD:** ER impingement occurred between the humeral component (HC) and inferior or posterior glenoid, regardless of version. With anteversion and IR, impingement occurred between the greater tuberosity (GT) and coracoid in 2/12 cases. All other IR impingement for all version positions occurred between the HC and anterior or inferior glenoid. Flexion resulted in impingement between the humeral calcar and coracoid: 2/12, 3/12, and 3/12 cases in anteversion, native, and retroversion, respectively. 1/12 impinged between the HC and anterior glenoid in flexion with retroversion. There was no flexion impingement for 10, 9, and 8 cases for anteversion, native, and retroversion, respectively. ADD impingement occurred between the HC and anterior or inferior glenoid. ABD with native and retroversion led to 1/12 and 2/12 cases of impingement between the lesser tuberosity (LT) and superior glenoid, respectively. Impingement in all other cases occurred between the GT or HC and superior glenoid or acromion.

**$60^\circ$  ABD:** There was impingement between the HC and inferior or posterior glenoid in ER for all version positions. 2/12 cases had no impingement in ER with retroversion and 1/12 with native version. In IR, there were 5/12 cases of impingement between the GT and coracoid with anteversion, 4/12 with native version, and 1/12 with retroversion. In 1/12 cases, impingement occurred between the LT and coracoid during IR with anteversion. IR impingement occurred between the HC and anterior, inferior, or superior glenoid in all other cases.

### *Impingement 32N Glenosphere (Table 2)*

**$20^\circ$  of ABD:** ER resulted in impingement in 3/12 cases between the HC and inferior glenoid in retroversion. Impingement only occurred between HC and glenosphere neck in native and anteversion. In IR, all impingement occurred between the HC and anterior or inferior glenosphere neck. There was 1/12 case of flexion impingement between the medial calcar and coracoid for each version position, but otherwise, no impingement. There was no extension impingement. ADD impingement occurred between the HC and glenoid or glenosphere neck. ABD impingement occurred between the GT or HC and acromion, superior glenoid, or superior glenosphere neck. Impingement between the LT and coracoid occurred in 1/12 cases with anteversion.

**$60^\circ$  of ABD:** With retroversion and ER, there were 7/12 cases of no impingement and 5/12 between HC and glenoid or glenosphere neck. With anteversion and IR, 4/12 had impingement between the GT and coracoid, while native and retroversion each had 1/12. Otherwise, 6, 11, and 11 cases impinged between the HC and glenoid or glenosphere neck for anteversion, native, and retroversion, respectively. There was no extension or flexion impingement.

