CT-based 3D Modeling of Glenoid Bone Preservation with Augmented Baseplates

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INTRODUCTION: Reverse total shoulder arthroplasty (rTSA) is a treatment option for a variety of shoulder pathologies, including rotator cuff arthropathy, glenohumeral arthritis, and irreparable rotator cuff tears and fractures. There has been substantial improvement in rTSA implants and surgical techniques, such as augmented baseplates that preserve bone tissue. In this study, we used 3D modeling to determine the extent of bone preservation with augmented baseplates in rTSA.

METHODS: CT scans from 50 consecutive patients before they underwent rTSA were used to create 3D models of each glenoid. The virtual positions of reverse shoulder baseplate implants were determined by consensus among four fellowship-trained shoulder specialists. Each patient model received a virtual nonaugmented baseplate, implanted with 100% backside contact, neutral scapular version, and 10° of inferior tilt, followed by one of three sizes of half wedge augmented baseplates. The extent of volumetric glenoid bone removal and lateralization of the baseplate was calculated for each scenario.

RESULTS: Preoperative CT imaging showed a mean 10.7° of retroversion and a reverse shoulder arthroplasty angle of 21.3° (³20° in 82% of cases). A medium augment (20° half wedge) was determined as optimal in 29 cases, and a large augment (30° half wedge) was considered optimal for the remaining 21 cases. The use of augmented baseplates was calculated to preserve 54% glenoid bone stock (1,989 ± 650 mm^3 bone removal versus 4,439 ± 1,636 mm^3 with nonaugmented baseplate; $P < 0.001$). The center of rotation for the augmented baseplates was an average of 4.1 mm lateral to the center for the nonaugmented baseplates.

DISCUSSION AND CONCLUSION: The use of augmented baseplates reduces the amount of bone that needs to be removed in rTSA. Furthermore, augmented baseplates result in relative lateralization of the glenosphere, which may improve soft tissue tension and limit impingement and scapular notching. Further exploration of the impact of augmented baseplates on clinical outcomes is needed.

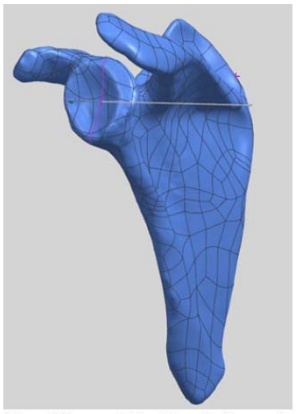

Figure 1. Representative 3D model of a scapula created from CT scans. The white line represents Friedman's line.

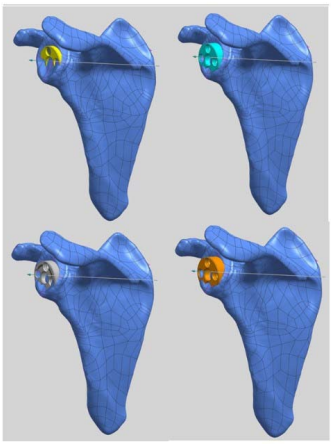

Figure 2. 3D models of a study participant's scapula with virtually implanted glenoid baseplates. Scapula with nonaugmented (top left), small augmented (top right), medium augmented (bottom left) and large augmented (bottom right) baseplate.