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Full Length Article

Quantifying the competing relationship between adduction range of motion and baseplate micromotion with lateralization of reverse total shoulder arthroplasty

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Abstract
Lateralizing the center of rotation (COR) of reverse total shoulder arthroplasty (rTSA) could improve functional outcomes and mitigate scapular notching, a commonly occurring complication of the procedure. However, resulting increases in torque at the bone-implant interface may negatively affect initial fixation of the glenoid-side component, especially if only two fixation screws can be placed. Shoulder-specific finite element (FE) models of four fresh-frozen cadaveric shoulders were constructed. Scapular geometry and material property distributions were derived from CT data. Generic baseplates with two and four fixation screws were virtually implanted, after which superiorly-oriented shear loads, accompanied by a compressive load, were applied incrementally further from the glenoid surface to simulate lateralization of the COR. Relationships between lateralization, adduction range of motion (ROM), the number of fixation screws and micromotion of the baseplate (initial implant fixation) were characterized. Lateralization significantly increases micromotion ($p = 0.015$) and adduction ROM ($p = 0.001$). Using two, versus four, baseplate fixation screws significantly increases micromotion ($p = 0.008$). The effect of lateralization and the number of screws on adduction ROM and baseplate fixation is variable on a shoulder-specific basis. Trade-offs exist between functional outcomes, namely adduction ROM, and initial implant fixation and the negative effect of lateralization on implant fixation is amplified when only two fixation screws are used. The possibility of lateralizing the COR in order to improve functional outcomes of the procedure should be considered on a patient-specific basis accounting for factors such as availability and quality of bone stock.