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POLYETHYLENE GLENOID COMPONENT BACKSIDE GEOMETRY INFLUENCES FIXATION IN TOTAL SHOULDER ARTHROPLASTY

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Summary: PURPOSE: Stability of the glenoid component is essential to ensure successful long-term outcomes following TSA, and may be improved through better glenoid component design. As such, this study assessed identical all-polyethylene glenoid components stability, having various fixation types, using component micromotion under simulated joint loading in an osteoarthritic patient cohort.

METHODS: Five all-polyethylene glenoid component designs were compared (Keel, Central-Finned 4-Peg, Peripheral 4-Peg, Cross-Keel, and Inverted-Y). Scapular models of six osteoarthritic male patients were assigned heterogeneous bone properties based on CT-intensity. A 'worst case' load magnitude of 125% BW of a 50th percentile male was used. A humeral component with a non-conforming radius of curvature applied a purely compressive load, followed by superior, superior-posterior, posterior, inferior-posterior, and inferior loads. Stability of the glenoid component was determined using the maximum normal and tangential micromotion in six regions of the glenoid component.

RESULTS: The greatest maximum normal micromotion occurred for the Inverted-Y component (109±43µm) in the anterior-inferior region of the glenoid component under a posterior-superior directed load. This was significantly greater than the other four components (Peripheral 4-peg, 61 ± 25 µm; $p < .001$, Keel, 89 ± 36 µm; $p < .001$, Central-Finned 4-Peg, 47 ± 19 µm; $p < .001$, and Cross-Keel, 92 ± 37 µm; $p = .002$).

The greatest maximum tangential micromotion occurred for the Cross-Keel component (146±46µm) in the posterior-superior region of the glenoid component under a posterior-superior directed load. This was significantly different ($p < .001$) from the other four components (Peripheral 4-peg, 111 ± 21 µm, Keel, 115 ± 34 µm, Central-Finned 4-Peg, 111 ± 39 µm, and Inverted-Y, 117 ± 34 µm).

CONCLUSION: This study addressed the contribution of all-polyethylene glenoid component fixation on component stability under simulated joint loading. Pegged components were significantly more stable than the keeled components. An inverse relationship between normal and tangential micromotion, with the greatest sliding (tangential micromotion) occurring in the direction of the applied load, and the greatest liftoff (normal micromotion) occurring opposite the applied load. This likely occurs due to polyethylene deformation of both the fixation features and articular surfaces.