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Effects of Dynamic Anterior Stabilization on In Vivo Glenohumeral Kinematics in the Treatment of Anterior Shoulder Instability

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Introduction and Background

The dynamic anterior stabilization (DAS) technique has been determined with promising clinical and biomechanical outcomes for treating anterior shoulder instability (ASI). However, the in vivo effects of DAS on glenohumeral kinematics during functional shoulder movement have not been fully elucidated.

Material and Method

Patients who underwent bankart repair (BR) or DAS for treating ASI patients with < 15% glenoid bone loss between May 2021 and December 2022 were enrolled. At 2-year follow-up, in vivo glenohumeral kinematics were quantified using a dual-fluoroscopic imaging system during the apprehension test and scapular abduction. Glenohumeral translations in the superior-inferior (S-I) and anterior-posterior (A-P) directions were compared between operative and contralateral shoulders.

Results

Eight patients were included in each BR and DAS group for final analysis, with comparable baseline characteristics between groups. During the apprehension test, the humeral head in BR shoulders were positioned significantly more anterior than that in contralateral shoulders during high external rotation angles of 80° (1.15 mm vs. -0.56 mm, $P = .012$) and 90° (1.81 mm vs. -0.27 mm, $P = .001$). In the DAS group, no significant differences were detected between bilateral shoulders in A-P translations at any external rotation angles (all $P > .169$). During scapular abduction, neither group demonstrated significant inter-shoulder differences in A-P or S-I translations (all $P > .262$).

Conclusions

For ASI patients with subcritical glenoid bone loss, isolated BR failed to fully stabilize the glenohumeral joint, as evidenced by the residual anterior humeral translation during terminal external rotation of apprehension test. In contrast, DAS successfully reestablished A-P glenohumeral stability while preserving physiologic S-I glenohumeral kinematics. The demonstrated kinematic superiority reinforces the potential of DAS as a first-line surgical option for the treatment of ASI with subcritical glenoid bone loss. Longitudinal studies with extended follow-up durations are warranted to validate the long-term safety and efficacy of DAS.



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Figure & Table 1.

