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## Improvement in Scapular Alignment and Clinical Outcomes After Scapular-Stabilizing Rehabilitation in Baseball Players with Scapular Dyskinesia: A 3-Dimensional Wing Computed Tomography Analysis

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### Introduction and Background

Scapular dyskinesia (SD) is a three-dimensional alteration of scapular posture and motion that may contribute to shoulder and elbow pathology in overhead athletes. Reliable quantitative assessment tools are limited.

To evaluate the relationship between clinical improvement and changes in scapular position after scapular-stabilizing rehabilitation in baseball players with scapular dyskinesia using three-dimensional wing computed tomography (3D wing CT).

### Material and Method

We retrospectively reviewed 108 baseball players (mean age, 16.9 years) with scapular dyskinesia and associated shoulder or elbow lesions who underwent 3D wing CT before and after rehabilitation. Scapular kinematic parameters-including upward rotation, superior translation, internal rotation, protraction, and anterior tilt-were automatically measured with validated software. Clinical outcomes were assessed using the American Shoulder and Elbow Surgeons (ASES) score and the visual analog scale (VAS) for pain. The symptomatic side was used for analysis. Paired t-tests or Wilcoxon signed-rank tests were applied according to normality.

### Results

A total of 108 baseball players with scapular dyskinesia were analyzed. The mean ASES score significantly improved from  $69.4 \pm 14.1$  to  $86.1 \pm 13.9$  ( $p < 0.001$ ), and the median VAS score decreased from 4 to 1 ( $p < 0.001$ ). Three-dimensional wing CT demonstrated a significant reduction in anterior tilt ( $7.5 \pm 4.8^\circ \rightarrow 5.4 \pm 3.7^\circ$ ,  $p < 0.001$ ) and a small decrease in internal rotation ( $54.1^\circ \rightarrow 53.1^\circ$ ,  $p = 0.017$ ), while other scapular parameters showed no significant change.

### Conclusions

Scapular-stabilizing rehabilitation significantly improved pain, function, and scapular alignment in baseball players with scapular dyskinesia. Three-dimensional wing CT objectively demonstrated these positional corrections, especially the reduction in anterior tilt, suggesting that restoration of scapulothoracic balance through targeted periscapular retraining plays a crucial role in improving scapular dyskinesia and reducing shoulder stress in baseball players.

