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The role of bone morphology of the greater tuberosity and lateral acromion on subacromial space during scaption: a three-dimensional dynamic simulation analysis

R. Brandariz[1], C. Charbonnier[2,3], A. Culebras[4], A. Lädermann[3,5,6], G. Cunnigham[1,3,6]

[1]Shoulder and Elbow Center La Colline, Geneva, Switzerland
[2]Medical Research Department, Artanim Foundation, Geneva, Switzerland
[3]Faculty of Medicine, University of Geneva, Geneva, Switzerland
[4]Department of Orthopaedic Surgery, Balgrist University Hospital, University of Zurich, Zurich, Switzerland
[5]Division of Orthopedics and Trauma Surgery, La Tour Hospital, Meyrin, Switzerland and
[6]Division of Orthopaedics and Trauma Surgery, Department of Surgery, Geneva University Hospitals, Geneva, Switzerland

Abstract

Background

The bone morphology of the greater tuberosity and lateral acromion plays a central role in subacromial impingement syndrome. The critical shoulder angle (CSA) and greater tuberosity angle (GTA) are two-dimensional measurement parameters that have been validated to evaluate it radiologically. These markers are, however, static and don't consider the dynamic effect of glenohumeral motion.

Objectives

This study aimed to better understand the biomechanics in subacromial impingement with a dynamic simulation based on a validated 3D biomechanical model coupling joint kinematics and 3D reconstructed computed tomography.

Study design & Methods

Sixty-one patients were included in this study: 44 with degenerative rotator cuff tears, 17 with glenohumeral instability. Patients with previous surgeries, traumatic cuff tears, and cuff tear arthropathy were excluded. CSA, GTA, and impingement-free range of motion (ROM) of the glenohumeral joint in scaption were calculated. Pearson (r) was used to determine the correlation between CSA and GTA, while Spearman (R) was used to determine the relationship between ROM and CSA, GTA, and combined CSA and GTA values. A T-test was used to compare group means.

Results

CSA and GTA were significantly higher in the rotator cuff tear group (P = 0.001 and <0.001), while ROM was significantly higher in the instability group (P = 0.001). There was no overall correlation between CSA and GTA (R = 0.02, P = 0.8). Individual correlation between both angles with ROM was negatively weak for CSA (R = -0.4, P < 0.001) and negatively moderate for GTA and ROM (R = -0.5, P < 0.001). However, combining both angles resulted in a negatively high correlation with ROM (R = -0.7, P < 0.001).

Conclusion

Subacromial space narrowing during scaption is highly correlated to the cumulative values of GTA and CSA. These findings suggest that the combined bony morphology of the lateral acromion and greater tuberosity plays an important role in subacromial impingement.

Level of evidence: III

Keyboards: Greater tuberosity angle, critical shoulder angle, subacromial space narrowing, shoulder scaption, dynamic ct scan.