Achieving Optimal Shoulder Stabilization in Massive Rotator Cuff Tear: Physically Depressing the Humeral Head is More Crucial than Concavity Compression Restoration (A Biomechanical Cadaveric Study)

Yoon Sang Jeon[1], Kyoung-Hwan Koh[2], Kee Jeong Bae[3], Sin Hyung Park[4], Ki Jin Jung, Dong Jin Ryu[5]
[1]orthopaedic surgery, College of Medicine, Inha University, [2]Asan Medical Center, University of Ulsan College O, [3]Seoul National University Boramae Medical Center, [4]Soon Chun Hyang University Bucheon Hospital, [5]College of Medicine, Inha University Hospital

INTRODUCTION:

The rotator cuff muscles contribute to maintaining stability by facilitating concavity compression to direct the humeral head into the glenoid. Furthermore, the superior rotator cuff is structurally contiguous with the capsule, assuming a static function in offering superior restraint. By using a simulation model, we aimed to compare these two roles and investigate which is more critical in the superior stabilization function of the rotator cuff. To the best of our knowledge, no study to date has compared the importance of the dynamic and static factors of the rotator cuff. Therefore, we have decided to explore the combined approach in MRCT using a subacromial spacer to physically depress the humeral head and magnets to restore concavity compression force in MRCT. This study aimed to biomechanically evaluate the effects of a subacromial spacer and magnets in MRCT, assessing their influence on superior stability individually and in combination. We hypothesized that the magnet-spacer combination would enhance their effectiveness in resisting superior humeral head migration and reducing peak subacromial contact pressures, while also intending to compare the two roles simultaneously.

METHODS:

A customized shoulder testing system tested seven fresh-frozen cadaveric shoulders. Each specimen underwent the following conditions: (1) intact rotator cuff without magnets, (2) MRCT without magnets; (3) MRCT with magnets, (4) MRCT with a spacer, (5) MRCT with magnets and a spacer. For each condition, superior migration and subacromial contact pressure were measured at 0°, 30°, and 60° abduction angles.

RESULTS:

Condition 2 resulted in a significant increase in both superior migration and subacromial contact pressure compared to condition 1. Condition 3 exhibited no significant differences in both parameters compared to condition 2 ($p > 0.05$). In condition 4, both parameters significantly decreased ($p < 0.05$), and in condition 5, levels were restored to those of the intact condition with no significant difference. Neither parameter between conditions 4 and 5 differed significantly ($p > 0.05$).

DISCUSSION AND CONCLUSION:

In a biomechanical model, the combination of magnets and a subacromial spacer successfully restored superior migration and reduced subacromial contact pressure after MRCT to levels comparable to the native condition. However, the subacromial spacer alone also showed positive results, and the influence of magnets was minimal. Therefore, for restoring the superior stability of the shoulder joint in MRCT, utilizing subacromial space occupiers to physically depress the humeral head seems like a more rational strategy than restoring concavity compression using magnets.