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Paper #125

Primary Stability of an Acromioclavicular Joint Repair Is Affected by the Type of Additional Reconstruction of the Acromioclavicular Capsule

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Summary:
Native translational stability can be restored by the addition of an AC capsule augmentation, while partial rotational instability remained.

Abstract:

Background

The synergistic effect of the acromioclavicular (AC) capsule and CC ligaments on AC joint stability has gained recent recognition for its importance. Biomechanical and clinical studies show the benefit of a combined reconstruction with multiple variations of surgical techniques for AC capsule augmentation. The ideal configuration of such capsular repair aimed at achieving optimal stability with an anatomic reconstruction remains unknown.

Hypothesis

Primary AC joint stability can be restored by an AC capsule augmentation, while position of the addi-tional suture construct is critical. It was hypothesized that techniques that reconstruct the anterior capsular structures would restore native stability against rotations and translations.

Methods

Thirty fresh-frozen human cadaveric shoulders were used. Each sample was tested in the native state and served as its control. After complete capsulotomy, one of five AC capsular repair configurations was performed : 1) anterior configuration; 2) superior configuration; 3) posterior configuration; 4) O-frame configuration; and 5) X-frame configuration. After testing of the AC capsular repair configurations, the tests were repeated following dissection of the CC ligaments and after CC ligament reconstruction with a suture button system. AC joint stability was immediately tested following each step under rotation and horizontal translation. In order to accomplish this, the AC joints were anatomically positioned on a cus-tom fixture linked to a servohydraulic testing system. A 3D optical measuring system was used to evalu-ate the 3D joint motion. Clavicle posterior translation in relation to the acromion, rotation around the long axis of the clavicle, and displacement of the lateral clavicle in relation to the center of rotation were measured. The torques and forces required to rotate and translate the clavicle were recorded.

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Results

Translational Testing: After the complete capsulotomy a significant reduction of resistance force with an average remaining resistance force of 13 – 20 % was found across all groups ($p<0.05$). All AC suture augmentations were able to significantly increase the average resistance force compared to the native ($p=0.01$) against posterior translation. Subsequent cutting of the CC ligaments did not result in a significant change in any of the groups ($p=0.23$). The synergistic effect of AC capsule augmentation and CC ligament reconstruction could be demonstrated without exception.
Rotational Testing: The complete capsulotomy resulted in a significant reduction of resistance torque in all groups ($p<0.05$) with a remaining torque ranged between 2 – 11 % across the groups. However, all AC suture constructs significantly increased the resistance torque compared to the capsulotomy ($p=0.01$). The subsequent cutting of the CC ligaments resulted in a significant change in two of the five groups (O-framed $p=0.01$ and X-framed $p=0.02$) and an overall remaining torque reduction ranging from 3 – 42 %. The combined reconstruction of AC capsule and CC ligament achieved the highest percentage of re-gained resistance torque, but still remained significantly weaker than the native specimen ($p=0.01$).

Conclusions

Native translational stability can be restored by the addition of an AC capsule augmentation, while partial rotational instability remained. The tested constructs demonstrated no significant individual differences. A combined AC capsule and CC ligament stabilization demonstrated the greatest capacity to restore the native stability against translational and rotational loads with specific configuration of the AC capsule repairs to be chosen according to the personal preferences of the surgeon.