

Tensile Characteristics of the Superior-Posterior and Anterior-Inferior Bundles of the AC Joint

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INTRODUCTION: Two distinct bundles of the acromioclavicular (AC) joint have been identified that contribute to the joint's stability. A detailed biomechanical characterization of the different bundles of the AC ligaments is important to surgically address the needs of the AC joint. The purpose of this study was to compare the ligament insertion areas and tensile strength of the superior-posterior (SP) and anterior-inferior (AI) AC joint bundles. Our hypothesis was the SP bundle would demonstrate a greater load to failure and other tensile characteristics than the less stabilizing AI bundle.

METHODS: 10 matched pair cadaver shoulders, 20 total, with an average age of 69.5 were used. After soft tissue dissection, the SP or AI bundle of the AC joint was isolated, with the other bundle isolated on the contralateral shoulder. The bundle was loaded to failure on an Instron material testing machine at 60mm/min. After testing, the ligament bundles were dissected from the bony surfaces to record the insertions areas with a 3-dimensional digitizing device (Microscribe). A paired t-test with significance set at $p < 0.05$ was used.

RESULTS: The SP insertion area on that acromion and clavicle, $454.5 \pm 203.8 \text{ mm}^2$ and $456.0 \pm 117.5 \text{ mm}^2$ respectively, was significantly greater than the AI, $239.0 \pm 64.1 \text{ mm}^2$ and $292.3 \pm 103.1 \text{ mm}^2$. The SP bundle ultimate failure and displacement at ultimate load were significantly greater than the AI bundle, $572.9 \pm 168.8 \text{ N}$ and $17.8 \pm 2.9 \text{ mm}$ versus $215.4 \pm 136.8 \text{ N}$ and $8.3 \pm 3.3 \text{ mm}$ respectively. Linear stiffness, yield displacement, yield load, and total energy absorbed were also significantly greater for the SP bundle compared to the AI bundle.

CONCLUSION: The tensile characteristics and the ligament insertion areas demonstrate that both the SP and AI bundles of the AC ligaments are significant anatomic structures with the SP bundle demonstrating greater structural integrity compared to the AI bundle. Therefore, when reconstructing the AC joint, both the SP and the AI bundle should be considered.