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Biomechanical Study and Preliminary Results for a Newly Developed Arthroscopic Coracoclavicular Ligament Reconstruction Using Tendon Graft

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Although more than 100 surgical techniques have been reported, there is no gold standard for the treatment of acromioclavicular joint dislocations. Furthermore, many of these techniques replace or reconstruct the coracoclavicular (CC) ligaments with one structure but do not account for the native two bundle anatomy of the CC ligaments. This finding has led us to design a new method of CC ligament reconstruction using an anatomic two bundle CC ligament reconstruction using a three tunnel technique and allograft tissue. The purpose of this study was to evaluate the biomechanical performance of this new double bundle, anatomic reconstruction in cadavers and to show the preliminary short term clinical results of this technique that was applied to patients who had AC dislocation with over grade III in Rockwood classification. Ten cadaveric shoulders were tested using a robotic/UFS testing system with 6-degree-of-freedom universal force/moment sensor (UFS-Model 4015; JR3 Inc. Woodland, CA). Biomechanical properties of the coracoclavicular ligament reconstructions and kinematics of AC joint were tested using this robotic system and compared to measurements from the native coracoclavicular ligaments. The trapezoid ligament had forces of 19.18±16.21 N and 56.03±17.80 N in the anterior and posterior load of 70N, respectively, and was significantly different from the conoid ligament (p=0.0022, 0.0012), which had in situ forces of 52.41±15.90 N and 15.53±18.06 N. The mean anterior, posterior, and superior displacement after anatomical CC reconstruction in cadaver was 7.24±3.24 mm, 6.41±3.67 mm, and 4.29±2.52 mm, respectively. There was no difference compared with the AC deficient shoulder which is defined as a control: p = .9064, .0729, .1328, respectively.

Also our study include 10 symptomatic shoulders(M/F : 7/3) with mean ages of 25.5 years who had X ray evidence of wide AC separation. All patients had painful restricted ROM and tenderness on the AC joint. Our novel technique was used to all patients. The semitendinosis tendon was harvested and passed through the coracoid via a drill tunnel placed at the anatomical footprint of the conoid ligament and then taken superolaterally through the clavicle to reconstruct the trapezoid ligament. Both ends of the tendon graft and the portion of the graft through the corocoid were secured using 5.5x8 mm PEEK screws by means of three point fixation. All patients were submitted to the same rehabilitation program and assessed subjectively and objectively after 3 months of the surgery using VAS, simple shoulder muscle power test, patient satisfaction and radiologic finding. All patients were remained pain-free with significant improved function and very satisfied with the results of this procedure. Mean displacement of distal clavicle on medial tip of acromion in simple shoulder AP radiograph was 2.1±1.8 mm at final follow up. No complication and infection was noted. In conclusion, the conoid and trapezoid ligaments were found to have different roles in horizontal motion of clavicle. Therefore, anatomical double-bundle reconstruction of both ligaments should be considered to properly restore of native kinematics after the AC joint injury