

The Effect of Coracoclavicular Fixation on the Stability of Type IIB Distal Clavicle Fractures Fixed with a Superior Locking Plate and Screws

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Summary:

In biomechanical testing, the addition of coracoclavicular suture anchor fixation to type IIB distal clavicle fractures fixed with a superior locking plate and screws increases stability significantly.

Abstract:

Purpose:

Surgical treatment of distal clavicle fractures is controversial. The role of coracoclavicular (CC) fixation on biomechanical stability in fractures fixed with plate and screws is not known. Our hypothesis is that coracoclavicular fixation will add stability to type IIB distal clavicle fractures treated with a superior locking plate and screws by neutralizing supero-inferior translational forces in the coronal plane.

Materials and Methods:

Twelve fresh frozen cadaveric specimens were used to create type IIB distal clavicle fractures in consistent manner. Matched pairs and DEXA scans were used to ensure similar bone quality. Group I (6 specimens) consisted of specimens stabilized with a superior precontoured distal clavicle locking plate, screws and supplemental coracoclavicular fixation using a suture anchor device. Group II (6 matched contralateral specimens) was the same construct without coracoclavicular fixation. Each specimen was cyclically loaded in the coronal plane at 40 to 80 N for 17,500 cycles (equivalent to cyclic loading on the protected shoulder in ambulating patient for 1 week). Load to failure testing up to 1000N was then performed on the specimens that did not fail cyclical loading. Outcome measures included the mode of failure and either the number of cycles or maximum load required to create 10 mm of displacement in the construct.

Results:

All specimens (12/12) completed the cyclic testing without failure and underwent load to failure testing. Group 1 specimens with CC fixation failed at a mean of 817 N (range, 675-980 N), whereas group 2 specimens without CC fixation failed at a mean of 438 N (range, 300-640 N) ($p=0.005$). All but two specimens in group 1 (4/6) failed by anchor pull out from the coracoid. One specimen did not fail at the maximal load the materials testing machine was capable of exerting (1000 N). One specimen failed by distal clavicle fracture fragment fragmentation. No coracoid fractures occurred. Group II specimens failed by distal clavicle fracture fragment fragmentation (3) and acromioclavicular (AC) joint displacement of greater than ten millimeters (1). Two group II specimens did not fail at the maximal load of the materials testing machine.

Conclusion:

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CC fixation is a useful adjunct to augment plate fixation in type IIB distal clavicle fractures.