PRESENTATION TITLE:
Biomechanical Comparison of Bicortical, Unicortical, and Unicortical Far-Cortex-Abutting Screw Fixations in Plated Comminuted Midshaft Clavicle Fractures

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STRUCTURED ABSTRACT (PURPOSE, METHODS, RESULTS, AND CONCLUSIONS) IN LESS THAN 400 WORDS:
Purpose: Plate fixation of displaced midshaft clavicle fractures has been a recent focus in the orthopedic literature, with several studies demonstrating higher levels of patient function, faster time to union, and decreased incidence of symptomatic malunion and nonunion when compared with nonoperative treatments. The objective of this study was to demonstrate biomechanical equivalence of bicortical locking fixation and a novel far-cortex-abutting (FCA) screw locking fixation in a superior-plated comminuted midshaft clavicle fracture model. FCA screws abut the inferior clavicular cortex without penetration, precluding placing adjacent neurovascular structures at risk as seen with bicortical locking screws. The secondary objective of this study was to show superiority of bicortical and FCA screw locking fixation compared with unicortical locking fixation.

Methods: Nine matched pairs of adult fresh-frozen cadaver clavicle specimens were randomized into 3 groups for bicortical, unicortical, or unicortical far-cortex-abutting locking plate fixation. Fluoroscopy was used to rule out any osseous abnormalities. All clavicles were instrumented using C-arm fluoroscopy to confirm appropriate screw length and positioning. A 1 cm osteotomy was created in each specimen to simulate a comminuted midshaft clavicle fracture. Biomechanical assessment of axial stiffness, torsional stiffness, and torsional load to failure was performed using a materials testing system. The addition of an extensometer allowed measurement of interfragmentary motion during cyclical axial loading. One-way ANOVA with Tukey adjustments for multiple comparisons and alpha set at 0.05 was used to compare stiffness and failure torque values between the three constructs.

Results: In cyclical torsion and torsion failure stiffness, both the bicortical and unicortical far-cortex-abutting constructs were significantly stiffer than the unicortical construct. There was no statistical difference between bicortical and unicortical far-cortex-abutting stiffness in cyclical torsion or torsional failure stiffness. Axial stiffness, fracture site stiffness, and fracture site displacement did not demonstrate any significant differences in cyclical axial loading between the three groups. One unicortical far-cortex-abutting construct exhibited loose fixation prior to testing with the MTS machine and was eliminated from the data after proving to be a statistical outlier.

Conclusions: Our study demonstrated the superiority of bicortical locking fixation compared with unicortical locking fixation in torsional loading to failure as well as validated the unicortical far-cortex-abutting locking construct in a fresh-frozen cadaveric model. The unicortical far-cortex-abutting mode of locking fixation was equivalent to bicortical locking fixation in both axial and torsional modes of loading and is attributed to the increased working length of the unicortical screws.

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1. Is there evidence for the biomechanical equivalence of bicortical locking fixation and a novel far-cortex-abutting (FCA) screw locking fixation in a superior-plated comminuted midshaft clavicle fracture model?
2. What is an anatomic risk of placing bicortical locking screws for a midshaft clavicle fracture?

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It is not known whether there is biomechanical equivalence of bicortical locking fixation and novel far-cortex-abutting screw locking fixation used in a superior-plated comminuted midshaft clavicle fracture. FCA screws abut the inferior clavicular cortex without penetration, precluding placing adjacent neurovascular structures at risk as seen with bicortical locking screws.