Paper - Basic Science

Paper Session: Biomechanics

# "Stress Taper" Strategy in Plate Fixation Increases Failure Strength in a Cadaveric Femur Model

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**Purpose:** To potentially limit peri-implant fractures, our institution commonly implements a fracture fixation strategy known as a "stress taper," in which the screw lengths toward the end of a construct are incrementally decreased. The premise is to dissipate the stress as one moves proximally in order to avoid a focal stress-riser when loaded. The aim of this study was to determine if the stress taper strategy increases torsional strength and fails in a simpler fracture pattern than the bicortical locking construct when biomechanically tested in a cadaveric femur model.

**Methods:** Seven matched pairs of cadaveric femora were randomly assigned to 1 of 2 distal femur fixation groups: plating with stress taper strategy or bicortical fixation. Both strategies used locking plates and the same number of locking screws in the same positions. Specimens were first cyclically loaded in axial compression and torsion. Specimens were then axially rotated to failure under 800 N of compression. Peak torque at failure and degrees of rotation at failure were calculated and compared using paired t tests. Fractures were categorized with the assistance of fluoroscopy according to the OTA classification, 32.

**Results:** Findings demonstrated significantly greater peak torque (110.6 ± 49.7 Nm vs 80.6 ± 35.2 Nm) and rotation at failure (23.8 ± 5.3° vs 18.9 ± 4.5°) in the stress taper group as compared to the bicortical group (P = 0.0424 and P = 0.0213), respectively. 6 of 7 fractures in the stress taper group were classified as 32 A1, with 1 of 7 classified as A2. 5 of 7 fractures in the bicortical group were classified as B1 and 2 of 7 classified as A2.

**Conclusion:** Stress taper fixation in femurs may be protective against peri-implant fractures compared to traditional bicortical fixation. Future research should entail a study of clinical outcomes comparing these 2 fixation strategies, including an assessment of the failure mechanism.

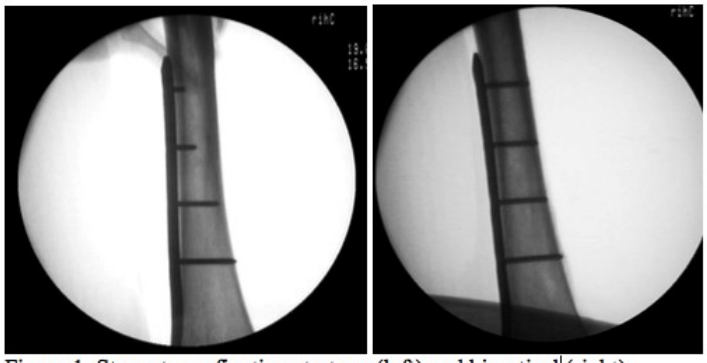

Figure 1. Stress-taper fixation strategy (left) and bicortical (right)