Does the Use of Locking Screws or Triceps Engagement Improve Resistance to Gapping in Small Olecranon Fragments?

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Purpose: Fixation of the olecranon must resist the pull of the triceps. Locking screw fixation in the displaced fragment and engagement of the triceps tendon using tines may improve fixation. We evaluated these two factors using a simulated in vivo cadaveric model.

Methods: 32 matched pairs of fresh-frozen, intact human cadaveric arms (age 59.7 ± 7.1 years) were used. After potting the distal humerus, high-tension cables were sutured directly to the triceps and brachialis tendons. A standardized OTA 21B1.1 transverse olecranon fracture was created in the posterior half of the joint yielding a small posterior fragment. Olecranon plates that have tines to engage the triceps and 2.7 locked screw holes in the proximal fragment were used. Four groups were evaluated. First, we divided the arms into Locked Screw (LS) and Nonlocked Screw (NS) groups (16 matched pairs each = 64 total limbs). For each pair, the tines were burred off the R or L side randomly. Screw trajectories were consistent through locking drill guides. Fragment fixation used only two 20-mm 2.7 locked or unlocked screws that did not lag the fracture site, simulating a worst-case scenario. Shaft screws were bicortical and unlocked. Simulated active motion was performed by driving the triceps and brachialis muscles using a custom, cable-actuator-driven robotic controller with real-time optical feedback (Optotrak Certus, NDI) of fracture gapping and motion. Dynamic fracture gapping data and applied triceps/brachialis loads were recorded during 200 flexion-extension cycles with forearm weight alone to assess physiologic function, followed by 30 cycles each with 1.25 lb, 2.5 lb, and 3.75-lb weights attached distally to assess supraphysiologic loading. Statistical data were analyzed using non-parametric Mann-Whitney U tests (α<0.05) using SPSS.

Results: Constructs with locked posterior screws demonstrated less gapping than unlocked screws irrespective of triceps engagement with tines (P<0.05). Tines with triceps engagement demonstrated less gapping in all conditions but fell short of statistical significance when unlocked screws were used, but not when locked screws were used.

Conclusion: In a cadaveric model of active motion after olecranon fracture fixation, locked posterior fixation performed better than unlocked fixation. Triceps engagement using tines was an advantage when unlocked screws were used posteriorly. We recommend the use of locking screws when limited fixation options are available for small olecranon fragments. When nonlocked screws are used in the olecranon, plates with tines may add to the stability of the fixation.