Dynamic Versus Static Distal Interlocks of Long Cephalomedullary Nails for Unstable Intertrochanteric Fracture

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Introduction: The incidence of unstable intertrochanteric fractures continues to increase. Presently it is generally agreed upon that long cephalomedullary nails are an acceptable treatment option, however exact indications for placement of distal locking screws remain debatable. The objective of this study was to compare the compression across the fracture site of unstable intertrochanteric femur fractures in a cadaveric bone model using two different distal fixation strategies, a statically locked long cephalomedullary nail versus a dynamically locked nail. Then to retrospectively look at dynamically versus statically locked nails for unstable intertrochanteric fractures at our institution.

Methods: Five matched pairs of fresh frozen cadaveric femora were randomly assigned to two treatment groups; dynamic and static distal interlock configurations with a long cephalomedullary nail. A standard unstable four part intertrochanteric fracture was created in all samples. Custom marker flags were secured to the proximal fracture fragment, distal fracture fragment, lag screw, nail and distal interlock to track three-dimensional motion under cyclic compression. Samples were loaded dynamically in compression at 700N (one times body weight of 70 kg) with a test frequency of 1 Hz for a total of 500 cycles. The relative three-dimensional motion of the proximal femur fracture segment (femoral head), distal femur fracture segment (shaft), nail, lag screw and distal interlock were measured by a motion tracking system and this data was synchronized with the load data. A two-way analysis of variance was utilized to detect statistically significant differences between the two treatment groups at 95% confidence interval.

Our Institution’s IRB committee approved this study. Medical records and x-rays of all unstable intertrochanteric fractures treated with a locked cephalomedullary nail were reviewed from 2006-2012. Failure rate was compared for dynamically versus statically locked nails at our institution.

Results: Following dynamic testing at a compressive load equivalent to one times body weight (700N), mean resultant fracture gap translation in dynamic configuration was 41% higher than the static locked samples (51.80±23.58 versus 30.93±12.04 mm; p<0.001). The fracture gap was compressed and accounted for 35% of the total resultant translation in the dynamic configuration whereas the fracture gap distracted by 4% of the total resultant translation in the static configuration (18.34±13.99 versus 1.55±6.01 mm; p<0.001) in the static configuration. In the dynamic configuration, intramedullary nail translated inferiorly along its axis by 3.98±2.4 mm compared to 0.18±0.83 mm in the static distal interlock configuration (P<0.008).

Forty-eight patients were with an unstable intertrochanteric fracture were treated with a locked long cephalomedullary nail. Fifteen were treated in a dynamic orientation and 33 were treated in a static configuration. The statically locked nails had a failure rate of 6.1% (2/33) compared to 0% (0/15, p = 0.145) for the dynamically locked nails.

Discussion: The dynamically locked nails had more compression across the fracture site compared to the statically locked nails and allowed for more inferior migration of the nail. Clinically we saw the dynamically locked nails had less failures than statically locked nails in unstable intertrochanteric in our small cohort of patients.

Significance: This increased compression across the fracture gap may provide a more favorable environment for healing in vivo.

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