

Biomechanical Evaluation of the Risk of Subtrochanteric Fracture after Femoral Neck Fixation: The Femoral Neck System versus Cannulated Screws

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INTRODUCTION:

The Femoral Neck System (FNS) is a fixed-angle side plate device approved for use in fixation of femoral neck fractures. The FNS perforates the lateral cortex of the subtrochanteric femur, which may increase risk of postoperative subtrochanteric fractures compared to the inverted triangle cannulated screw (CS) construct. The purpose of this biomechanical study was to compare forces required to create subtrochanteric fractures in FNS and CS constructs.

METHODS:

Osteopenic sawbones were divided into 5 groups: Non-instrumented femurs, CS with the inferior screw proximal to the midpoint of the lesser trochanter ("normal position," CSN), CS with the inferior screw distal to the lesser trochanter ("low position," CSL), one-hole plate FNS, and two-hole plate FNS. Specimens were loaded to failure on a Servohydraulic Test System. Means and standard deviations were calculated for load to failure. Each group was paired and analyzed using two-sample t-tests.

RESULTS:

Load to failure was greater for the CSN group compared to CSL ($p=0.04$). Load to failure was greater for one-hole plate FNS versus CSL ($p=0.002$) and CSN ($p=0.05$). Load to failure was greater for two-hole plate FNS versus CSL ($p=0.006$) but not versus CSN ($p=0.16$). Load to failure was similar between one- and two-hole FNS ($p=0.24$). Constructs in order of greatest to lowest load to failure by means, though not all statistically significant were: Control (2950 N), one-hole plate FNS (2542 N), two-hole plate FNS (2444 N), CSN (2318 N), and CSL (2102 N).

DISCUSSION AND CONCLUSION:

The FNS demonstrated failure at the subtrochanteric femur in this synthetic femora biomechanical model. The load to failure of FNS was superior compared to CS placed below the level of the lesser trochanter. The load to failure of the one-hole FNS was also superior to CS placed proximal to the midpoint of the lesser trochanter.

