INTRODUCTION:
Compression hip screws (CHS) and Blade Plates have been successful in treating intertrochanteric hip fractures. CHS may remain the preferred treatment for stable intertrochanteric fractures [1]. Axial and rotational stability is important for adequate fixation. A new device, InterTAN CHS, which marries CHS with two integrated interlocking screws, provides resistance to axial and rotational loading while maintaining reduction and strength (Figure 1a). The implant, however, leaves a larger explanted defect in the femur as compared to predicate devices. The purpose of this study was to evaluate the structural strength effect of a lateral defect created during implantation of this new device using both finite element analysis (FEA) and biomechanical cadaveric testing.

METHODS:

Finite Element Analyses
Three-dimensional CAD models cortex-only femora were reworked to form lateral defects simulating screw insertions per the corresponding surgical technique for InterTAN CHS, Classic CHS plate, and the TC-100 Blade Plate, respectively. A ten-node modified quadratic tetrahedron element FEA model was set up in ABAQUS/CAE Version 6.6-1. Linear elastic isotropic material properties were assign to the bone models.

FEA analyses were restricted to the proximal region of the implant at a distance equal to 101.6 mm (4 inches) below the tip of the lesser trochanter. Models were fixed distally with all translational degrees of freedom being constrained. A unit load was applied to the femoral head through its center in and orientation of 10 degrees lateral and 10 degrees posterior.

RESULTS:

Finite Element Analyses
FEA stress distributions among the three implants differed the most at the lateral defect region (Figure 2). The peak stress of the new Intertan CHS device was shown to be 44% lower than CHS and 68% lower than the Blade Plate for 10/10 axial compressive bending. These finding indicate that for these testing conditions, the proximal screw holes in the Intertan CHS system does not affect the structural strength of the bone.

Biomechanical Cadaveric Testing
Ultimate load-to-failure values in the 10/10 axial compressive bending were not affected by the explantation lateral defect, when the Intertan CHS was compared to the Classic CHS Plate or the TC-100 Blade Plate. A two-tailed Student’s paired t-test indicated no statistically significant difference between Intertan CHS and contralateral implant type (p = 0.27 at α = 0.05 when compared to the Classic CHS Plate, and p = 0.16 at α = 0.05 when compared to the TC-100 Blade Plate).

DISCUSSION:
The size of lateral defect left from explantation of the Intertan CHS device did not detrimentally influence the overall bone substrate mechanical strength when tested in a computational gait model or in a biomechanical cadaveric model as compared to the CHS and Blade Plate. The new Intertan CHS device functions to resist rotational instability and should be considered clinically acceptable when gait cycle loading is considered.

REFERENCES: