Compression Buttress Screw Fixation for the Treatment of Vertical Femoral Neck Fractures: A Biomechanical Comparison With Traditional Sliding Compression Fixation

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Purpose: We sought to compare the biomechanical properties of compression buttress screw (CBS) fixation to traditional fixation with sliding compression mechanisms, multiple parallel cannulated lag screws (MPCS) fixation, and dynamic hip screw (DHS) with derotation screw fixation for the treatment of unstable vertical femoral neck fractures (FNFs).

Methods: 40 synthetic femoral models with simulated Pauwels type III fractures (angle of 70°) were equally assigned to one of 4 fixation groups: MPCS fixation in triangle and inverted triangle configurations, 130° DHS with derotation screw fixation, and the CBS fixation. Within each group, half of the specimens were randomly assigned to 2 loading settings, an axial compression loading test and a hip-flexion torsion test.

Results: For axial compression, no significant difference of load to failure and stiffness could be detected between the CBS and DHS fixations ($P = 0.9777$)). Both CBS and DHS fixations exhibited superior axial strength and stiffness than the MPCS fixation groups. The displacement at the inferior cortex of the CBS fixation was statistically less than those of other 3 groups under different loads (all $P<0.05$). However, no significant difference was found at the superior cortex among the 4 fixation groups at any load. The torsional strength and stiffness were the highest for the inverted triangle MPCS fixation group (all $P<0.01$). There were no significant differences with regard to torsional strength and stiffness between the CBS and DHS fixation.

Conclusion: CBS fixation provides comparable biomechanical performance for axial compression and torque as the DHS fixation with derotation screw, and superior capability to resist varus forces. Our results suggest that CBS fixation is a promising alternative to the traditional sliding compression fixation constructions for the surgical management of vertical FNFs.