**Biomechanics of Femoral Neck System (FNS) in Pauwels Type III Fractures**

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**Purpose:** The femoral neck system (FNS) is the most recent implant system used for femoral neck fixation. Unstable Pauwels type III fractures with fracture angle of 50° to 70° have the highest rate of postoperative complications. Therefore, the study investigated the effectiveness of single-hole and 2-hole FNS for different fracture angles.

**Methods:** Unstable Pauwels type III fractures at 2 different angles of 50° and 70° were created in 4th generation Sawbone models (model #3406) using 3-Matics (Materialise, Belgium) software. The implant models were generated by scanning the implants (DePuy Synthes [Johnson & Johnson]) on Xtreme CT-II scanner (Scanco, Switzerland). A 10- noded tetrahedral mesh was generated for bone and implants in Altair Hypermesh software 2020.1. Linear elastic and isotropic material models were used for the bone as well as for the implants. Walking gait cycle was simulated in ANSYS (2020.R2).

**Results:** Single-hole FNS experienced higher displacements and implant stress than double-hole FNS. With the increase in fracture angle, the von Mises stress in the implants increases; however, the strain in the bone decreases. This signifies that with the increase in the verticality of the fracture angle, higher load was transmitted through the implant rather than the bone. In the single-hole FNS for 70° fracture angles, the von Mises stress in the implants exceeds the endurance limit of Ti-6Al-4V (410 MPa)

**Conclusion:** An increase in fracture angle leads to higher implant stresses for both single-hole and double-hole FNS. The double-hole FNS exhibited lower stresses. The stresses in single-hole FNS suggest further investigations into likelihood of fatigue failure.