**Very Little is Known about What Causes Femoral Neck Stress Fractures at the Tissue Level**

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**DISCUSSION:** The vast majority of authors still seem to, whether inadvertently or inadvertently, follow Wolff’s tension/compression paradigm by using the classical nomenclature set forth by Fullerton and Snowdy to classify FNSFs. Of the papers that explicitly mention the possible loading conditions that induce a FNSF, there are generally two camps. The first camp is in line with Wolff’s paradigm that typical walking/standing induces a bending moment at the FN that produces net tensile strains on the superior neck that lead to stress fracture development, and net compressive strains leading to stress fracture on the inferior FN (Fig. 1). The second camp is consistent with the mechanical interpretation put forth by Egol et al. (Fig. 2), wherein normal loading the hip abductor muscles neutralize the tensile forces across the superior FN. When these muscles become fatigued the neutralizing effect is minimized and net tensile strains are then experienced by the superior FN, which can eventually lead to stress fracture. A similar comment has been made in the field of anthropology (Fig. 3). Only Edwards et al. [13] made mention of shear force in the development of FNSF. In their review article, Bernstein et al. [7] call into question the existence of an isolated-tension-sided fracture. They point out that in the large series of patients with FNSFs diagnosed via MRI reported by both Rohen-KQuiniquilla et al. [10] and Steele et al. [11] that no isolated tension-sided FNSFs were observed. Bernstein et al. [7] postulate that due to the lack of MRI based evidence for tension-sided FNSFs it is likely the tension-sided fractures reported in radiograph-based studies were actually minimally displaced complete fractures. Whether or not there are truly isolated “tension-sided” FNSFs, the vast majority of FNSFs do occur along the inferior portion of the FN. We hypothesize that perhaps, similar to the description of Egol et al., the action of the hip abductor muscles could move the neutral axis of the FN such that it is in the vicinity of the superior cortex of the FN, and this could explain why the vast majority of FNSFs are seen along the inferior cortex of the neck. In other words, the strain is magnified because the inferior cortex is even farther from the neutral axis than what would be seen in the T/C paradigm (neutral axis in the middle of the neck) (Fig. 1). An upward shifting neutral axis in the setting of some torsion (typical of hip loading) would also increase shear stresses.

**SIGNIFICANT/CLINICAL RELEVANCE:** The literature is strongly biased by the Wolffian view of femoral neck loading that is likely inaccurate. Accurate knowledge of the loading conditions occurring at the femoral neck is needed to devise effective interventions for promoting osteogenesis in the femoral neck, especially in the context of typical and activity-related changes in the regional distribution of stresses/strains (mode and magnitude) and the development of FNSFs.

**REFERENCES:**


**Figure 1 (from Wolff, see Skedros and Baucom 2007)**

**Figure 2 (from Egol et al. 1998)**

**Figure 3 (from Lovejoy 1998, see Skedros et al. 2023)**

**REFERENCES:** The complete list of references identified in our literature search can be found at: [https://teambone.com/themes/](https://teambone.com/themes/)