Does Construct Stiffness Really Matter in Plated Distal Femur Fractures? Re-Evaluation of a Previously Defined Construct Rigidity Score

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Purpose: Distal femur fractures are a common orthopaedic injury with nonunion as a well-recognized complication that frequently leads to reoperation. Known patient-specific risk factors for nonunion include obesity, open fracture, infection, and smoking. It is proposed that modifiable factors related to construct rigidity may also be related to nonunion. The purpose of this study is to identify risk factors for distal femoral fracture nonunion at our institution as well as apply a previously published lateral locked plating construct rigidity score for external validation.

Methods: This was a single-institution, retrospective case series of adult patients who underwent operative fixation of the distal femur (AO/OTA types 33A and 33C) between 2008 and 2017 at a Level I tertiary referral trauma center. Patient demographics and comorbidities, injury characteristics, and fixation characteristics were gathered by chart review and examination of initial, postoperative, and final follow-up radiographs. Nonunion was defined as the need for a secondary procedure to improve bony healing or lack of radiographic signs of healing at 6 months postoperatively. A construct rigidity score was calculated using the algorithm previously published by Rodriguez et al. Fisher's exact test was used to evaluate categorical variables. The Student t test was used to analyze the relationship of fracture displacement and distance from the articular surface to nonunion. P values were set at <0.05.

Results: We identified 209 patients who underwent operative fixation for distal femur fractures, 147 of whom had minimum 3-months follow-up (70.3%). 12 of the 147 patients (8.2%) underwent reoperation secondary to nonunion. Initial displacement on injury radiographs (sagittal + coronal plane) was significantly associated with nonunion (P <0.001). The use of titanium alloy plates was associated with an increased nonunion rate (21% vs 2.4%, respectively; P <0.003). The use of shorter plates (≤9 proximal holes) resulted in a higher rate of nonunion than the use of longer plates (16.7% vs 2.7%, P <0.02). Flexible constructs (rigidity scores 0-2) had an increased risk of nonunion when compared to stiff constructs (rigidity scores 3-5) (22.2% vs 2.2%, respectively; P <0.007). No nonunions were identified in the cohort of 14 patients with the constructs that were most stiff (rigidity score 5).

Conclusion: In this cohort of 147 patients, we found that initial fracture displacement, titanium material, and shorter plate length are associated with the development of nonunion after operative treatment of distal femur fractures. Contrary to prior reports, this data does not support the notion that increasing construct stiffness leads to higher nonunion rates.