Comparison of Three Methods for Maintaining Interfragmentary Compression After Fracture Fixation

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Background/Purpose: Intra-articular distal femur fractures are often stabilized with hybrid constructs (locking and nonlocking fixation) after fracture reduction. Generally, it is thought that lag screw fixation should precede any positional screw or locking screw application. The purpose of this study is to compare three different methods of maintaining interfragmentary compression after reduction and compression of the fracture with a reduction clamp.

Methods: Femur Sawbones (Pacific Research Labs) had an intra-articular vertical split fracture created using a jig and bandsaw. A pressure transducer (FlexiForce, Tekscan) was then placed in the fracture between the medial and lateral femoral condyles, and a pointed peri-articular reduction clamp was then used to compress the intra-articular split to approximately 20 lb of pressure in all specimens. 3.5-mm cortical lag screws (group 1), 3.5-mm cortical position screws (group 2), and 5.4-mm distal locking screws through a distal femur locking plate (group 3) were then placed across the fracture using standard technique and a torque limiting screw driver (lag and positional screws at 2 Nm, locking screws at 4 Nm). There were four specimens per group. The clamp was then removed and the amount of residual interfragmentary compression was measured. After 2 minutes a steady state was reached and the pressure was measured again. Statistical analysis was performed using Kruskall-Wallis analysis of variance for the initial force after clamp removal and Wilcoxson signed rank test for comparing baseline pressure to steady state pressure. Significance was set for P values less than or equal to 0.05.

Results: There was no significant difference between the three groups with respect to initial force applied with the clamp. Locking screws placed through the plate (group 3) maintained 27% of the initial force applied by the clamp ($P = 0.043$), positional screws maintained 90% of the initial force applied by the clamp (not significant), and lag screws increased by 240% the initial force applied by the clamp ($P = 0.043$).

Conclusion: When reducing intra-articular fractures and applying interfragmentary compression with reduction clamps, additional lag screws significantly increase the amount of compression seen at the fracture interface. Compressing a fracture with reduction clamps and relying on only locking screws through a plate results in a significant loss of interfragmentary compression, and should be avoided--particularly when treating intra-articular fractures. This study lends biomechanical support to the notion that hybrid techniques (lag screws before locking screws) for fracture fixation help to maintain optimal interfragmentary compression.

See pages 47 - 108 for financial disclosure information.