How Do Pilon Fractures Heal? An Analysis of Dual Plating, Biomechanically Matched Fixation, and Callus Formation

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Purpose: Recent literature has suggested the use of multiple implants and supplemental dual column plating of pilon fractures, either to support fragments on the opposite side of the bone or to provide additional mechanical support to the comminuted metaphyseal region. It is uncertain whether supplemental plating augments or impairs healing in pilon fractures. It is also unclear whether this fixation is rigid enough to negatively impact callus formation. The purposes of this study were: (1) to determine the effect of single versus dual plate metaphyseal fixation for pilon fractures on callus formation and reoperation rates, (2) to determine the effect of biomechanically optimal versus mismatched fixation on callus formation and reoperation rates, and (3) to determine whether any patient or surgical factors were independent predictors of callus formation or need for reoperation.

Methods: A retrospective comparative study was designed, which included 50 patients with AO/OTA type C2 or C3 pilon fractures treated with plate fixation over a 12-year period at a single institution. Comparisons were made between patients with single versus dual plate metaphyseal spanning fixation, and patients treated with biomechanically optimal (eg, medial implant for a varus injury) or mismatched fixation. Modified Radiographic Union Score for Tibial fracture (mRUST) scores at 3 and 6 months were calculated, and reoperation rates were determined.

Results: At 6months, mean mRUST scores were significantly lower in patients treated with dual metaphyseal plates compared to those with a single plate (8.7 vs 10.4, P = 0.046). In the multivariate analysis, presence of an open fracture (OR [odds ratio] 51.05, P = 0.008) was the only risk factor for reoperation. Screw density between 0.4 and 0.5 was a protective factor against reoperation (OR 0.03, P = 0.026). Biomechanically mismatched fixation did not affect mRUST scores or reoperation rates.

Conclusion: Pilon fractures treated with a single plate formed more callus 6 months after surgery compared to those treated with dual plate fixation, and there was no difference in reoperation rates. Screw density between 0.4 and 0.5 was a protective factor against reoperation. Open fractures were more likely to require a revision operation. This data may serve as the basis of future work to determine the ideal fixation construct for the frequently comminuted metaphysis in pilon fractures. Data on screw density and reoperation rates may inform surgeons who treat these injuries.