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CORR Insights

CORR Insights®: Addition of a Medial Locking Plate to an In Situ Lateral Locking Plate Results in Healing of Distal Femoral Nonunions

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Where Are We Now?

Distal femoral nonunions are generally difficult to treat and remain a serious clinical problem for orthopaedic surgeons. There are multiple factors that can lead to nonunion, including patient factors (diabetes, smoking, and obesity), fracture factors (metaphyseal comminution and the presence of an open fracture), and fracture construct factors (fixation and bone graft). In some cases, the use of locking plates resulted in decreased callus formation [5]. Recently, nonunion of distal femur fractures treated with lateral locking plates were found to contribute to nonunions because of overly rigid fixation [3–5]. The analysis led to the discovery that using longer plates, and not filling the holes adjacent to the fracture site, would allow for some desirable micromotion at the fracture site. Additionally, the use of "far cortical" locking screws, in which the near cortex is overdrilled, allowing for some micromotion, has shown promise [2].

On the other hand, excess motion can lead to an unstable construct, nonunion, or failure of the hardware. In the current study, Holzman and colleagues noted the presence of excess motion at the fracture site in some patients treated for nonunion, prompting them to investigate the use of more rigid fixation by the addition of a medial plate.

The premise of the study by Holzman and colleagues is that sometimes using only lateral locking plates can create an unstable environment contributing to nonunions. Whether this is because of a large area of metaphyseal comminution, poor bone quality, or some combination remains unclear. Though the authors of the present study emphasize the biomechanical environment, biological factors were also noted in patients with periosteal stripping for the soft tissues around the fracture site. The use of bone graft and bone graft substitute may also play a role in creating an environment for healing. The authors noted the results of two previous studies [1, 6] which found that nonunions were treated with a lateral fixed-angle device and bone grafting, achieving similar rates of union.

Where Do We Need To Go?

The ability to determine preoperatively just what treatment would lead to uncomplicated healing is the goal of

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any surgeon, whether treating a distal femur or other fracture. The multifactorial nature of achieving this goal is why there might not be one best answer for all patients. This study highlights the biomechanical factors involved, and how understanding the biomechanical environment to predict preoperatively the best construct would help prevent nonunions.

The current study evaluated a care algorithm for nonunions, but did not compare alternative treatments. As stated by the authors, future research should also be directed towards determining what types of distal femoral nonunions may benefit from the medial plate, in addition to what patient and fracture characteristics may contribute to nonunion formation. Indeed, this raises the question of whether medial plating should be used in acute fractures in order to prevent fracture site motion as reported by the authors.

Future studies could potentially compare some of the numerous viable approaches to this clinical problem, including lateral locked plating, medial and lateral locked plating, and the use of bone grafting. Those studies should involve at-risk patients who have fractures with metaphyseal comminution. Future investigators should seek to standardize—or better still, compare—the use of adjuncts to treatment (like bone morphogenetic protein) and surgical approaches (such as staged surgery or different approaches to plating).

How Do We Get There?

This article raises the issue of biomechanical stability for an ideal fracture environment. Previous studies determined the use of a lateral locking plate might be too stiff to provide optimal callus formation and fracture healing. The authors seemed to find there are other patients in which too much fracture site motion occurs. Solving this question, in addition to studying other factors contributing to a distal femur nonunion, should involve studying the unstable fractures with metaphyseal comminution and treating them with optimal lateral plates (sufficient length, submuscular placement) versus lateral and medial plates at the initial surgery. Identifying when bone grafting should be used at the outset would be another important variable to consider, as well as randomizing patients into bone graft and no bone graft groups.

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