

## **A Firm Shake Leads to a Strong Union: Stability Six Weeks following Humeral Shaft Fracture Predicts Healing**

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**Purpose:** While the majority of humeral shaft fractures go on to heal with nonoperative treatment, fracture nonunion can be a significant complication. The purpose of this study is to assess the ability of fracture site gross motion on physical examination to predict humeral shaft progression to healing or nonunion in patients managed nonoperatively using a functional brace.

**Methods:** 84 patients undergoing nonoperative treatment of a diaphyseal humeral shaft fracture at our institution were identified. Clinical examination for fracture stability was performed on all patients by the treating physician at each postinjury follow-up. 328 visits were examined to assess for radiographic and clinical healing. All patients included had complete follow-up through bony union or intervention. Significance was assessed via Pearson's  $\chi^2$  analysis and logistic regression, with level of significance set at  $P < 0.05$ .

**Results:** 73 of the 84 patients (87%) healed their fracture within our study cohort by 6 months postoperatively. The physical examination test for humeral shaft stability at 6 weeks follow-up identified fracture healing with 98% sensitivity, with 72 of 73 unions correctly identified. Testing at the 6-week mark also had 82% specificity with a false positive rate of 18.2%. Positive predictive value and negative predictive values were 97% and 90%, respectively. Pearson's  $\chi^2$  test demonstrated a statistically significant association between gross motion at 6 weeks and nonunion formation,  $\chi^2(1) = 58.99$ ,  $P < 0.001$ . When fracture morphology and patient age were controlled for, gross fracture motion on physical examination at 6 weeks retained significant association with development of nonunion using multivariate logistic regression.

**Conclusion:** Clinical examination of fracture site stability at 6 weeks is an accurate and reliable tool for identifying those individuals with humeral shaft fractures that will likely heal to union. Those with gross motion at this time point should be educated in and evaluated for early surgical intervention to speed time to healing. With a high positive predictive value, fracture stability at 6 weeks should be assessed in every patient to predict which patients will most likely result in fracture healing.