

**Initial Malalignment of Humeral Shaft Fractures Predicts Failure of Bracing: Results of a Treatment Protocol**

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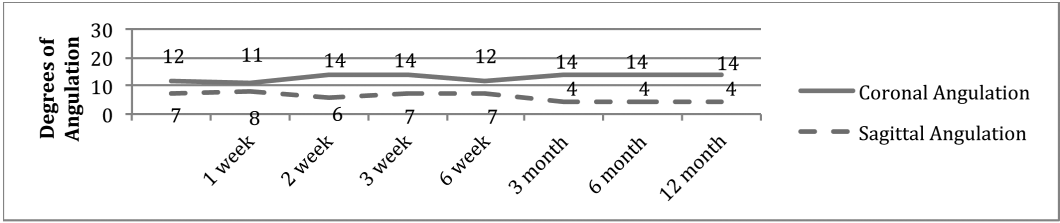
**Purpose:** The majority of humerus shaft fractures are managed nonoperatively with functional bracing. The purpose of this study was to evaluate changes in fracture angulation throughout the course of treatment with functional bracing.

**Methods:** 522 radiographs from 72 patients who underwent nonoperative management of 72 humeral shaft fractures were critically reviewed. All patients were treated by a fellowship-trained traumatologist at a single institution utilizing an “off the shelf”, plastic humeral fracture brace. Fracture patterns were classified according to AO/OTA system. Fracture angulation and displacement were measured in the coronal and sagittal planes on the picture archiving and communication system (PACS) before and after brace application. In the coronal plane, a line was drawn down the long axis of the humeral shaft; varus angulation was defined by positive values and valgus angulation by negative values. In the sagittal plane, procurvatum was defined by positive values and recurvatum was defined by negative values. Images were assessed post-brace application and at 1 week, 2 weeks, 3 weeks, 6 weeks, 3 months, 6 months, and 12 months. Mean coronal and sagittal angulation was calculated for each of the above intervals. Linear regression was performed for both coronal and sagittal measurements to mathematically define the observed changes between follow-up periods.

**Results:** All fractures were followed to healing or surgical intervention, (minimum 12 weeks); average final follow-up was 40 weeks. 66 patients (91.7%) successfully healed their fractures with nonoperative treatment. The average angulation observed on immediate post-brace radiograph was 12° varus and 7° procurvatum. At final follow-up average coronal angulation was 14° varus and 4° procurvatum. Fracture angulation changed a mean 2° in the AP plane and 3° in the sagittal plane over the course of care. 14 patients had a fracture in greater than 20° of varus after brace application, 4 of whom eventually underwent operative intervention (29%). Linear regression demonstrated fracture angulation progresses at a rate of 0.01° varus and 0.01° of posterior angulation per day.

**Conclusion:** Humeral shaft fractures treated nonoperatively heal with minimal change in angulation from initial brace application. Provided there is no history of repeat trauma and no cosmetic deformity, radiographs should be obtained at the following intervals: immediately after application of brace, 6 weeks, 3 months, 6 months, and 12 months. Increased radiographic evaluation is warranted when patients initially present with greater than 20° of varus angulation, as this degree of displacement was associated with a higher rate of conversion to operative fixation. Otherwise, patients should be followed with only history and physical examination at follow-up points prior to the 6-week radiographic evaluation.

**Figure 1.** Mean changes in angulation over time.



- The FDA has not cleared this drug and/or medical device for the use described in this presentation (i.e., the drug or medical device is being discussed for an “off label” use). For full information, refer to page 600.