Does Soft Tissue Envelope Affect Rates of Union in Functional Brace Treatment of Humeral Shaft Fractures?

Gwyneth C Maloy, Martha Kebeh, Christopher Schneble, Gregory Ronald Roytman, Erin Stockwell, Brianna Fram

INTRODUCTION: It has been suggested that soft tissue envelope size limits success of functional bracing for humeral shaft fractures. The current study therefore aimed to evaluate the relationship between soft tissue envelope thickness and progression to union with functional bracing. We hypothesized that soft tissue thickness and union would not correlate.

METHODS:

Using ICD-9 and ICD-10 codes, we identified patients with humeral shaft fractures who underwent at least 6 weeks of functional brace treatment at our institution from 2011-2024. Patient demographics, injury characteristics, and treatment outcomes were collected.

Soft tissue envelope, including the relative thickness of muscle and fat, was measured laterally at the surgical neck of the humerus and at the deltoid tuberosity using post-reduction radiographs and those taken at the two-, four-, and six-week follow-up visits. Statistical analysis was performed with Chi-square or Fisher exact tests for categorical variables and one-way analysis of variance (ANOVA) or Kruskal-Wallis testing for continuous variables. Statistical significance was set at $p<0.05$.

RESULTS:

Fifty-eight patients met inclusion criteria. Thirty-five (60.3%) progressed to union with functional brace treatment, whereas 23 (39.7%) underwent surgery for failure of progressive union or had nonunion as their final outcome. Current smoking status was significantly associated with nonunion ($p=0.028$). Union outcome was not significantly associated with age, sex, body mass index (BMI), smoking status, endocrine disease, injury mechanism, or AO/OTA classification (all $p>0.05$).

For soft tissue measurements, patients who progressed to union with bracing had less muscle at the deltoid tuberosity (median 12.8mm (IQR 10.3-17.9) versus 22.5mm (18.6-23.7); $p=0.015$) four weeks after injury. Aside from this, union outcome was not associated with soft tissue measurements of fat, muscle, or total tissue thickness at any other time point (all $p>0.05$).

DISCUSSION AND CONCLUSION:

No association was found between increasing soft tissue thickness around the humerus and rate of progression to union with functional brace treatment of humeral shaft fractures.