

mRUST Scores Can Describe Boney Union, But Can They Predict Patient Function and Pain?

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Purpose: The Modified Radiographic Union Scale for Tibial Fractures (mRUST) has high inter- and intrarater reliability, making it a useful tool to monitor and describe healing of long bone fractures. However, factors other than healing as assessed by mRUST may contribute to long-term pain and physical function. Indeed, the association of mRUST to pain and physical function has not been established. The purpose of this study was to determine if 3- and 6-month (mo) mRUST scores are associated with pain severity, physical function, and pain interference (PI) 12 mo after definitive fixation. We hypothesized that 3- and 6-mo mRUST scores would not be associated with patient-reported outcomes at 12 mo.

Methods: 70 subjects with tibia or femur fractures requiring surgical fixation and without history of chronic pain (age 42 ± 15 years; 54% male) were recruited from a Level-I trauma center. mRUST scores 3 and 6 mo after definitive fixation were assessed by 2 physicians with discrepancies moderated by a fellowship-trained trauma surgeon. Pain severity, physical function, and PI were assessed at 12 mo. Pain severity was measured using the Brief Pain Inventory (BPI) while physical function and PI were measured using PROMIS (Patient-Reported Outcomes Measurement Information System) Physical Function (PF) and PIScores, respectively. Spearman's rho was used to evaluate correlation coefficients between 3- and 6-mo mRUST scores of the entire cohort and 12-mo outcomes. Subsequent correlation analysis stratified patients into mRUST scores ≤ 10 (nonunion) versus ≥ 13 (union).

Results: mRUST scores of the entire cohort ($N = 70$) at 3 and 6 mo were not associated with pain severity, physical function, or pain interference at 12 mo (3- and 6-mo rho range, 0.06-0.14; $P > 0.20$). In patients with union at 3 or 6 mo ($N = 54$), no correlation was found between mRUST score and pain severity, physical function, or PI at 12 mo (3- and 6-mo rho range, 0.03-0.18; $P > 0.20$). In patients with nonunion at 3 and 6 mo ($N = 16$), lower mRUST scores were associated with increased pain severity at 12 mo (3-mo BPI rho, -0.54 , $P = 0.04$; 6-mo BPI rho -0.87 , $P = 0.01$) but not physical function (3-mo PF rho 0.37, $P = 0.18$; 6-mo PF rho 0.06, $P = 0.90$). Lower 3-mo mRUST scores were associated with more pain interference (3-mo PI rho -0.56 , $p = 0.03$) unlike 6-mo scores (6-mo PI rho -0.58 , $P = 0.13$).

Conclusion: The mRUST is not related to pain severity, physical function, or pain interference at 12 mo in patients who are healed. This indicates that factors other than boney union must be considered in a patient's long-term outcomes. However, worse bone healing in patients with nonunion is associated with increased pain at 12 mo. This suggests more aggressive early management of patients with poor bone healing may be warranted to halt the progression to poor long-term outcomes. While it appears that low mRUST scores do confer a higher risk of poor outcomes, high mRUST scores do not provide any assurance of good clinical outcome.