Does Fixation Method Affect the Correlation of mRUST and Healing Strength?

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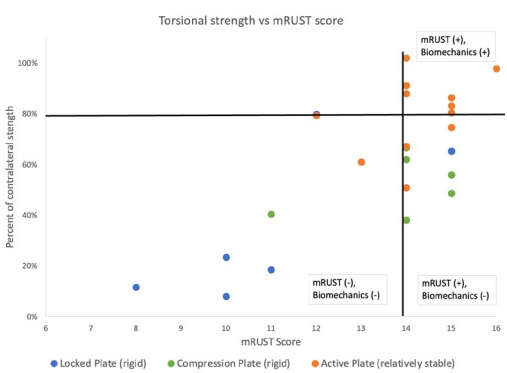
Purpose: The modified Radiographic Union Scale in Tibial Fractures (mRUST) is used for evaluation of fracture healing in the clinical setting with excellent interobserver reliability. Previous biomechanical studies correlating strength of healing with mRUST are limited to a single mode of intramedullary fixation. This study evaluated the correlation between mRUST and biomechanical strength in an ovine fracture healing model using fixation methods with varying stiffness that generate different modes of healing.

Methods: Biomechanical data were sourced from previous ovine osteotomy studies and included 24 sheep, 12 fixed with rigid constructs (bicortical locking or compression plating) and 12 fixed with a relatively stable construct (active plate). The sheep were sacrificed at 9 weeks and the tibias were loaded to failure in torsion. Failure load was recorded as a percentage of the contralateral intact tibia. The mRUST score was recorded from standardized 9 week radiographs (AP and 2 oblique lateral views) by 3 orthopaedic trauma surgeons. A fracture was considered biomechanically healed if it retained 70% of the strength of the contralateral side; mRUST >13 was evidence of radiographic healing. We hypothesized the mRUST would align with biomechanical healing status in both rigid and relatively stable fixation cases.

Results: The ICC (intraclass correlation coefficient) for the mRUST was 0.93 (95% confidence interval [CI] 0.86-0.97). As a percentage of the intact contralateral tibia, rigid constructs had a much lower load to failure (mean 43%, standard deviation [SD] 23%) than the relatively stable group (mean 80%, SD 14%). In the rigid fixation group, the mRUST score correctly aligned with biomechanical healing state in 5 of 12 fractures. Specifically, it correctly identified 5 fractures ununited and incorrectly identified 6 fractures healed and 1 fracture not healed. In the relative stability group, the mRUST correctly aligned with biomechanical healing state in 9 of 12 fractures. Specifically, it correctly classified 9 fractures as united and incorrectly categorized 3 fractures as healed.

Conclusion: Previous biomechanical evaluations of mRUST only included relatively stable intramedullary fixation. This is the first study to evaluate the biomechanical accuracy of the mRUST in fracture models with both rigid and relatively stable fractures. The mRUST predicts eventual healing, with excellent interobserver reliability in clinical studies. However, one should use caution when applying the score to fractures stabilized with rigid fixation methods, as mRUST scores suggested fracture healing despite opposing biomechanical evidence.



The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or medical device they wish to use in clinical practice.