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Validating the Modified Radiographic Union Score for Tibia for Children With Femoral Shaft Fractures

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Purpose: The ability to measure bone healing and union is essential in assessing efficacy of fracture treatments and ensuring optimal patient outcomes. The modified Radiographic Union Score for Tibia (mRUST) was developed to quantitate radiographic findings in adult tibial shaft fractures as a means to measure and define a spectrum of radiographic healing. This study assesses the reliability of mRUST in pediatric femoral shaft fractures, and assesses its correlation with clinical and patient-reported outcomes.

Methods: This is secondary analysis of a randomized control trial comparing outcomes for pediatric patients in Tanzania treated with either titanium elastic nails or Kirschner wires for femoral shaft fractures. Patients in this study were followed up at 6 weeks, 3 months, 6 months, and 1 year postoperatively using clinical (Squat and Smile), patient- and parent-reported (Pediatric Quality of Life [PedsQL]), and radiographic (mRUST) assessments. Reliability between reviewers was assessed using Cohen's kappa and Bland-Altman plot analysis. Descriptive statistics, t-tests, analysis of variance, and Spearman's correlations were used, as appropriate, to describe the relationships between patient-/parent-reported and radiographic outcomes.

Results: A total of 52 patients were identified as having sufficient radiographic information to determine mRUST scores. There was a mean difference of 0.05 (95% confidence interval [CI]: –0.10-0.19), and a 95% limit of agreement ranging from –1.71 to 1.62 between mRUST reviewers. The average mRUST scores for patients who were able to place their hip below the level of their knee was higher than those who could not ($P = 0.02$). mRUST scores were found to be lower in patients with nonunions ($P<0.01$). There was a strong correlation between mRUST and PedsQL child and parent scores ($P = 0.75$ and $P = 0.77$, respectively, $P<0.01$).

Conclusion: The mRUST has both concurrent and divergent validity based on associations with health-related quality of life, functional outcomes, and follow-up time. This study suggests the mRUST is both reliable and valid as a quantitative measure of radiographic healing of pediatric femoral shaft fractures.