

## Of Mice and Men: Temporal Comparison of Modified Radiographic Union Scores for Tibia Fractures (mRUST) Between Mouse and Human Femoral Shaft Fractures Treated With Intramedullary Nails

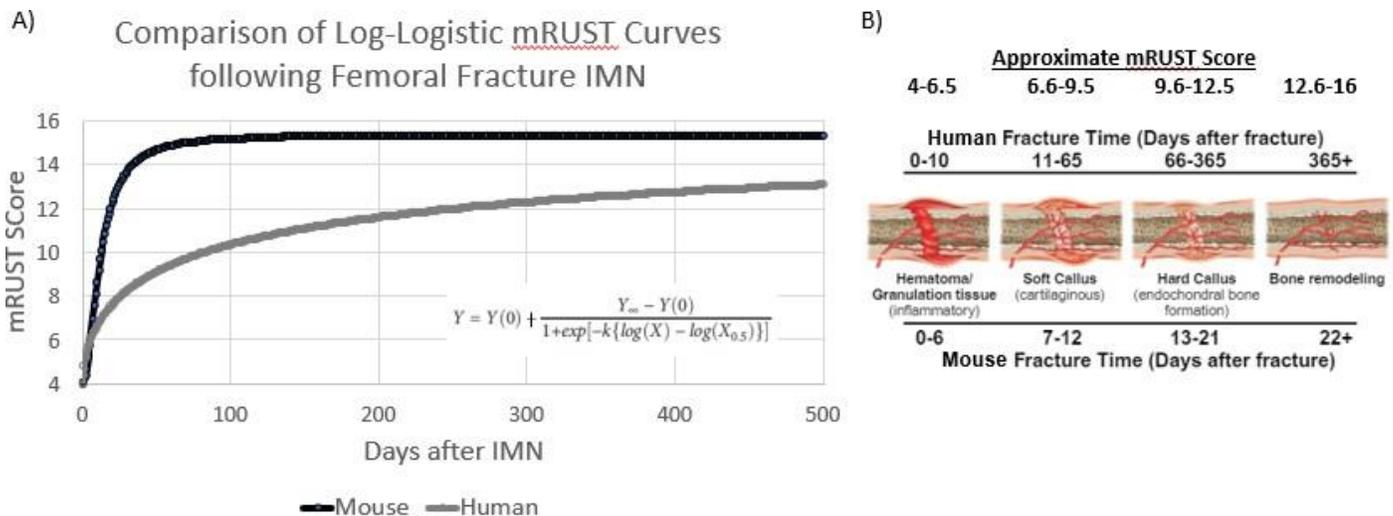
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**Purpose:** Mouse models of fracture healing are employed to understand bone healing, but the temporal relationship to human fracture healing is poorly understood. We hypothesized time frames corresponding to the stages of endochondral fracture healing could be identified.

**Methods:** Radiographs of mice and human femur fractures treated with intramedullary nails (IMNs) were reviewed. 321 human femur fractures aged 18-55 (OTA/AO 32A-C) that healed were included. Patients with pathologic fractures and reoperations were excluded. 158 three-month-old C57BL6/J mice were used for the fracture model. Multiple orthopaedic surgeons performed mRUST scoring. A 3-parameter log-logistic curve was fit to describe fracture healing over time –  $Y_{\infty}$  (max score at  $t = \infty$ ),  $k$  (healing rate), and  $X_{0.5}$  (time to half-healing).

**Results:** Parameter estimates are given as value (95% confidence interval). For mice,  $Y_{\infty} = 15.38$  (15.20-15.56),  $k = 4.43$  (4.14-4.71), and  $X_{0.5} = 12.08$  (11.76-12.39). For humans,  $Y_{\infty} = 16.73$  (16.20-17.25),  $k = 1.32$  (1.25-1.39), and  $X_{0.5} = 100.29$  (91.96-108.61). All parameters were statistically significantly different comparing mice to humans ( $P < 0.05$ ). The figure depicts fracture healing stages and comparative time frames.

**Conclusion:** We identified times corresponding to stages of endochondral fracture healing in mice and humans using mRUST. This data is relevant for designing or interpreting fracture healing studies in mice to translate how observation and intervention timing corresponds to humans.



**Figure:** A) mRUST vs time comparing mouse to human and B) Approximate timing post-fracture at which different stages of endochondral bone formation are occurring