Assessing Mouse Model Based Femur mRUST Scores via Intelligent Fracture Detection and Deep Learning Neural Networks

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Bone fractures are a major issue worldwide**.** Beyond the physical affects, fractures may result in substantial economic burden due to hospitalization costs, surgical procedures, and rehabilitation. Modified Radiographic Union Score for Tibia fractures (mRUST) is a method for evaluating long-bone fracture healing in humans using plain radiographs. Preliminary data from mRUST scored femoral midshaft mouse femurs proved the utility of mRUST in murine models. While mRUST is a reliable technique, it can be a time consuming and labor-intensive process. Additionally, there are concerns about inter-rater reliability. Radiographs are taken twice weekly for 42 days, and each radiograph must be prepared by cropping the image to include the femurs only for assessment. We proposed that artificial intelligence (AI) can be used to expedite the scoring of radiographic images and create uniformity throughout the process to enhance the consistency of the analysis of mRUST scores and produce results faster than humans. Using an AI/machine learning (ML) algorithm we allowed AI to analyze femoral shaft fracture radiographs that previously received an mRUST score by our orthopaedic surgeons. Following analysis, mRUST scores generated from AI were compared to the scores generated from the orthopaedic surgeons. Results indicated that the mRUST scores generated by AI matched the scores produced by the surgeons with 96% accuracy. Based on these findings, our team was able to enhance the production of mRUST scores by limiting the time that is required to score radiographs. Future studies will determine whether comparable results can be obtained for different skeletal sites and with human x-rays. Eventually, we hope to predict early after surgery who is likely to heal or go on to nonunion. Early intervention could substantially decrease pain, morbidity, and healthcare costs.