The Future is Mobile: Validating Apple Health as Novel Orthopaedic Trauma Outcome Metric

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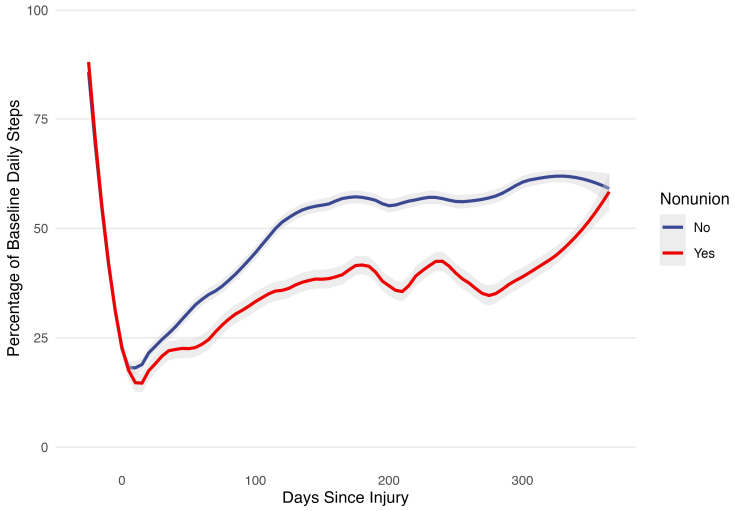
INTRODUCTION: Surgeons often lack objective data on patient functional outcomes, particularly in comparison to the patient's baseline. Smartphone-based mobility metrics may provide valuable longitudinal data on functional outcomes after lower extremity fracture surgery. This study aimed to determine whether gait parameters recorded on Apple iPhone devices are sensitive to the mobility changes of injury and recovery, correlate with patient-reported outcome measures, and differentiate between patients with and without a nonunion.

METHODS: A cross-sectional study included adult patients with lower extremity fractures who owned iPhones and had at least 6 months of follow-up. Participants shared Apple Health data and completed Patient Reported Outcomes Measurement Information System (PROMIS) surveys for pain and physical function. Five gait parameters were analyzed: step count, walking asymmetry, double support, walking speed, and step length. Mixed-effects models compared mobility parameters at pre-injury, acute post-injury, and 6-months post-injury timepoints. Correlations between mobility parameters and PROMIS physical function and pain scores were assessed. A mixed-effect model evaluated the relationship between step count recovery and nonunion surgery.

RESULTS: 107 patients participated. The most common fracture types were tibial plateau (14%), distal femur (13%), and femoral shaft (13%). All mobility parameters demonstrated significantly increased impairment from pre-injury to acute post-injury, with step count showing a 93% reduction ($p<0.001$). Step counts increased 6-fold from the first month post-injury to the sixth month ($p<0.001$), while remaining 50% below baseline in the sixth month. All gait parameters correlated with PROMIS physical function scores but not with pain scores. Patients with a known nonunion had a 39% slower step count recovery than those without a nonunion ($p<0.001$).

DISCUSSION AND CONCLUSION: Apple Health mobility parameters effectively captured changes in mobility after lower extremity fracture and with subsequent recovery. These metrics correlated with patient-reported physical function and distinguished between patients with and without nonunions, demonstrating their validity as objective, real-world functional outcome measures. These "digital biomarkers" may aid clinical decision-making, research, and be used as tools to target early intervention for patients at risk of poor outcomes.