Predictors of Splint Adherence and Outcomes Following Volar Plating of Distal Radius Fractures

Yehuda A. Masturov[1], Sebastian D. Arango[1], Jacob H. Zeitlin[1], Jason C. Flynn[2], Lauren DeTullio[1], Andrew J. Miller[1], Tristan B. Weir[1]
[1]Philadelphia Hand to Shoulder Center, Philadelphia, PA, [2] Sidney Kimmel Medical College, Philadelphia, PA
yehudamasturov17@gmail.com

Disclosures: Yehuda A. Masturov (N), Sebastian D. Arango (N), Jacob H. Zeitlin (N), Jason C. Flynn (N), Lauren DeTullio (N), Andrew J. Miller (N), Tristan B. Weir (N)

INTRODUCTION: Postoperative immobilization in a thermoplastic forearm splint is standard after distal radius open reduction and internal fixation (ORIF), yet true adherence is difficult to quantify and may influence outcomes. Embedded temperature sensors offer objective wear-time measurement. With the use of an integrated temperature sensor to monitor splint wear, we hypothesize patients have high compliance with postoperative thermoplastic splint wear following distal radius fracture open reduction internal fixation (ORIF). Secondarily, we hypothesize that patient-reported splint wear significantly correlates with actual splint wear.

METHODS: This prospective observational study was performed at a single tertiary referral upper extremity surgery practice. Patients who received elective ORIF with a volar plate requiring at least four weeks of immobilization in a thermoplastic splint postoperatively were invited to join the study. Patients were excluded if they were lost to follow-up, had non-elective surgery, complex injuries affecting the immobilization protocol, bilateral distal radius repair, revision for nonunion/malunion, required a dorsal approach, dorsal bridge plate, external fixator, or had a tumor/infection diagnosis. Eligible patients were given a temperature sensor fitted forearm volar splint at their first postoperative visit (as described by Weir et al.) and instructed to wear the splint as much as possible. Upon enrollment, participants provided information on demographics, circumstances surrounding injury, pre-existing hand conditions, previous surgeries/date (if applicable), and initial hand therapy treatment date. Upon sensor removal, patients were asked how many hours per day, on average, they believed they had worn their splints.

RESULTS: Based on sensor measurements, overall compliance in subjects enrolled thus far (n=37) had a median of 88.3% [IQR: 59.8% – 94.9%]. Daytime compliance was 85.2% [56.3% – 93.2%] and nighttime compliance was 94.7% [77.2% – 99.7%] **(Figure 1)**. This difference was statistically significant according to a paired t-test (P = 0.001). There was no statistically significant difference in overall compliance between dominant- and non-dominant-sided fractures (P = 0.803). Patient-reported compliance was strongly correlated with actual compliance based on sensor data **(Figure 2).** Pearson's correlation coefficient between actual compliance and reported compliance showed a strong positive correlation (r = 0.662 [95% CI: 0.438 – 0.887], P = 0.014).

DISCUSSION: This data corroborates previous work, further validating the temperature sensors as reliable and reproducible means of measuring compliance with postoperative immobilization protocols. Patients do have some insight into their compliance with postoperative recommendations, as there was a statistically significant correlation between patient-reported and actual compliance with splint wear. Limitations include patient loss to follow up and inaccurate patient reported adherence. Future analyses will be designed to evaluate key thresholds for postoperative immobilization in order to optimize patient outcomes.

SIGNIFICANCE/CLINICAL RELEVANCE: Objective monitoring demonstrated high splint wear and a strong correlation between patient-reported and actual wear, supporting the use of brief self-report when sensors are unavailable. Sensor data can also flag lower daytime adherence, enabling targeted counseling and therapy planning to optimize recovery.

FIGURES

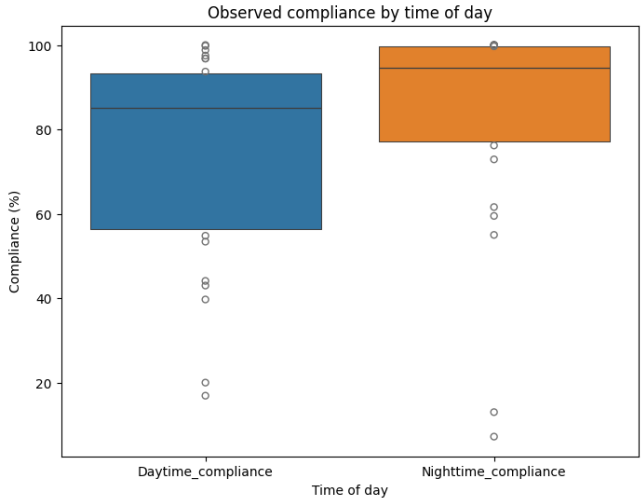

Figure 1. Observed compliance rates of splint wear among the 37 patients enrolled in our study thus far, separated by daytime (6 a.m. until 10 p.m.) versus nighttime (10 p.m. until 6 a.m.). Boxes represent the interquartile range, with the median indicated by a horizontal line.

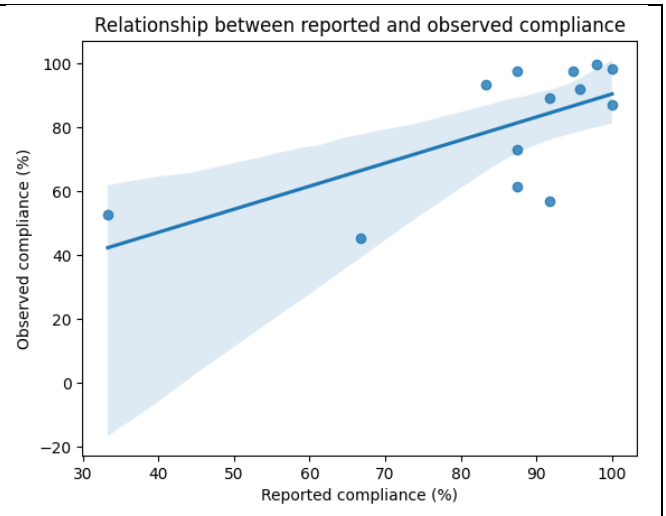

Figure 2. Scatter plot demonstrating the relationship between self-reported compliance (x-axis) as a percentage of time worn throughout the day and observed compliance (y-axis), as measured by the temperature sensor data.