

A Wearable, Wireless Device Monitors Sacral Pressure During Operative Cases

Nicholas Fadell BS¹, Seonggwang Yoo PhD², William Mortiz MD¹, Joseph Ribaudo BS¹, Ida Fox MD¹, Justin M. Sacks MD MBA¹, John Rogers PhD², Amanda Westman PhD¹

¹Division of Plastic and Reconstructive Surgery, Washington University in St. Louis

²Querrey Simpson Institute for Bioelectronics, Northwestern University

Background:

- Pressure ulcers contribute to significant morbidity and mortality in all healthcare settings, costing the healthcare system \$11 billion annually.
- Due to complications and costs of treatment for pressure ulcers, prevention is more effective for both patients and hospitals.
- Current prevention methods for pressure ulcers, such as risk scales and pressure-offloading beds, are not cost effective and fail to capture up to 60% of patients who develop ulcers.
- A lower-cost option is the manual repositioning of patients at set time intervals, but to do so efficiently would require a more accurate tool to objectively assess risk in each patient
- Our group has developed a wearable, wireless patch to continuously monitor sacral pressure to aid healthcare workers in repositioning patients effectively.

Objective:

- Evaluate the feasibility of the wearable, wireless Mercury Patch sensor for continuously monitoring sacral pressure in a surgical setting.

Methods:

- Patients scheduled to undergo surgery for over 4 hours were approached for consent.
- The Mercury Patch was placed onto patients’ lower backs in the operating room prior to surgery.
- An accelerometer was placed onto the operating table to record changes in table position.
- Data from the Mercury Patch and the accelerometer were continuously recorded during the surgery using an iPhone.
- Patients’ lower backs were examined before and after device placement as well as at 1 week follow up.

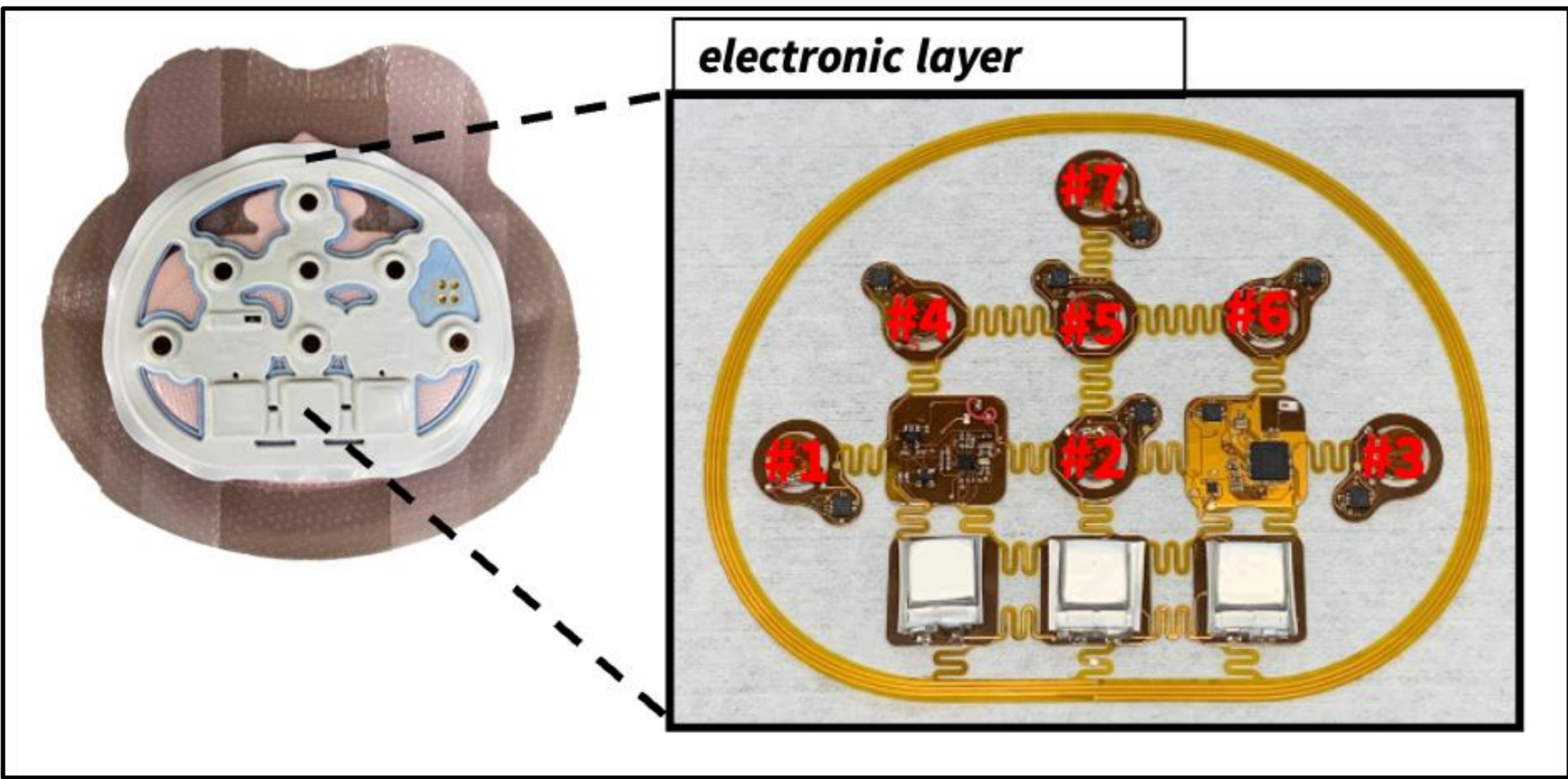


Figure 1: Device schematic displaying position on Allevyn dressing and 7 pressure sensors

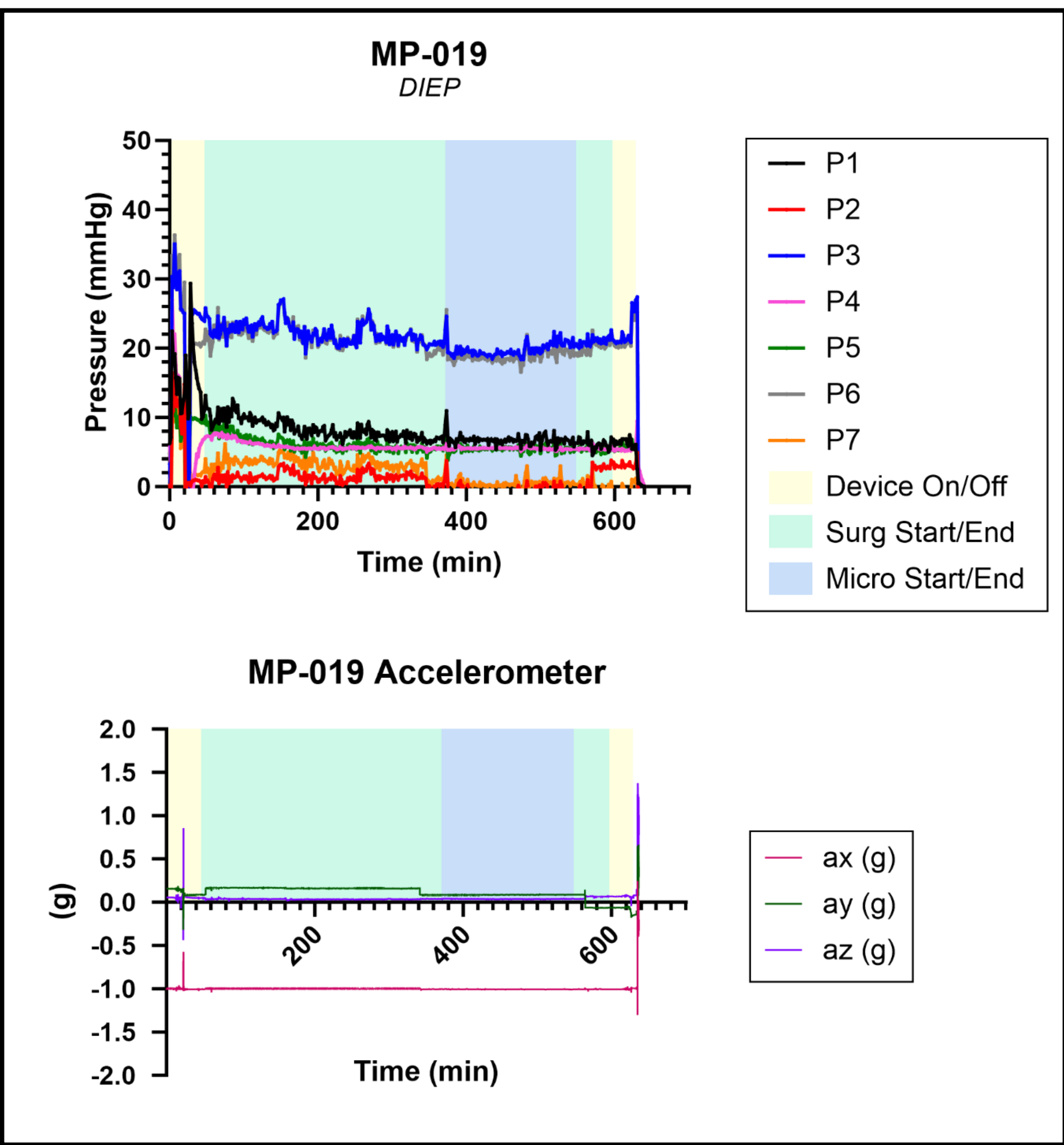


Figure 2: Example of Mercury Patch pressure readings across a surgical case, with corresponding accelerometer data

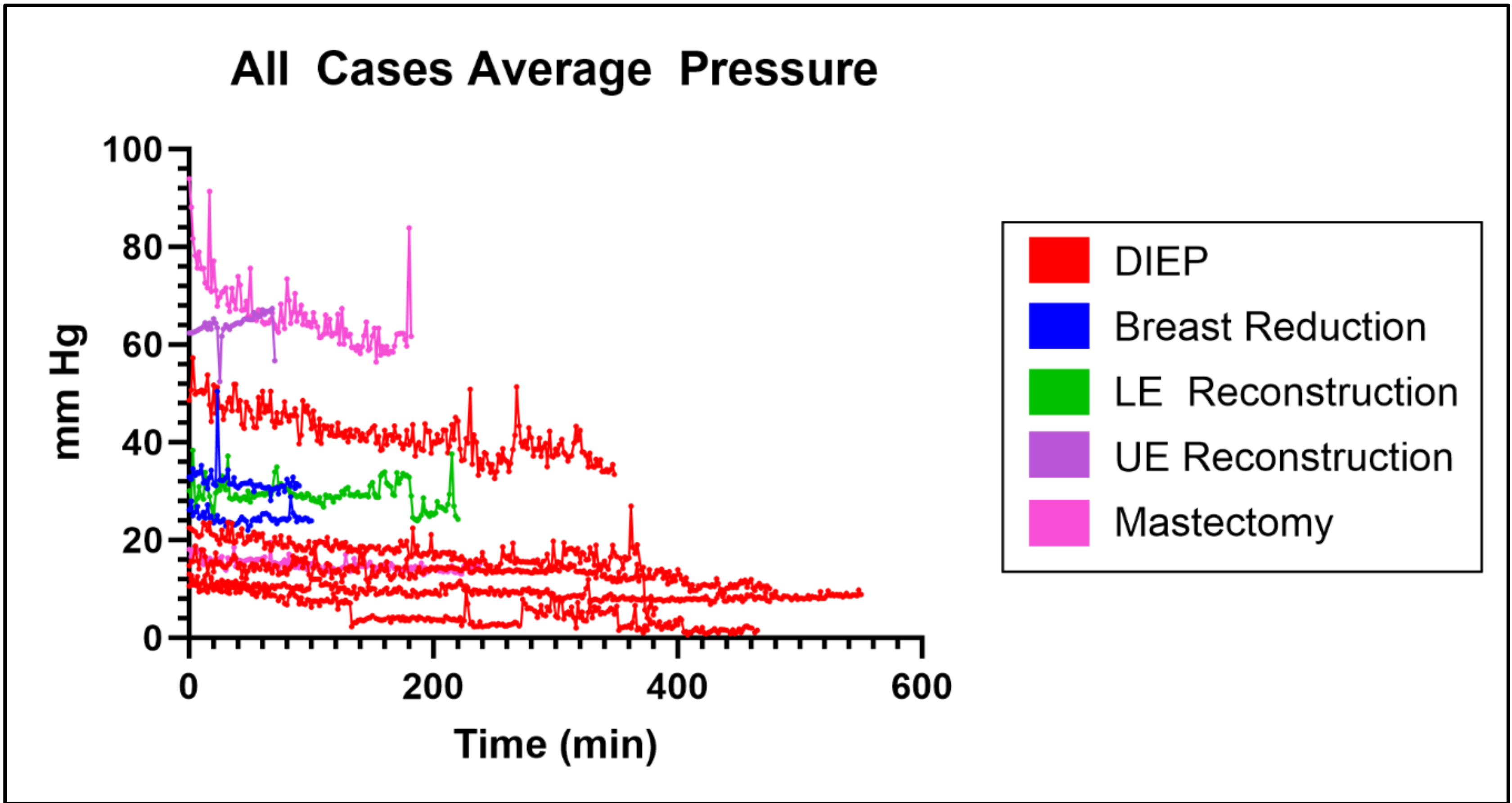


Figure 3: Display of all pressure readings across all cases

Results:

- The Mercury Patch was successfully utilized in 11 patients’ surgeries and recorded sacral pressure continuously without interrupting care.
- The device was also able to capture the minimization of pressure changes during microsurgery.

Conclusions:

- The Mercury Patch is feasible for real-time monitoring of sacral pressure in the clinical setting.
- Further research in higher-risk patients is needed to determine pressure values and durations concerning for ulcer formation.

References:

1. Padula WV, Makic MBF, Wald HL, et al. Hospital-Acquired Pressure Ulcers at Academic Medical Centers in the United States, 2008-2012: Tracking Changes Since the CMS Nonpayment Policy. 2015;41(6):257-263.
2. Qaseem A, Mir TP, Starkey M, Denberg TD. Risk Assessment and Prevention of Pressure Ulcers: A Clinical Practice Guideline From the American College of Physicians. Ann Intern Med. 2015;162(5):359–12. doi:10.7326/M14-1567.