

Artificial Intelligence Guided Customized Rehab for Parkinson’s Disease

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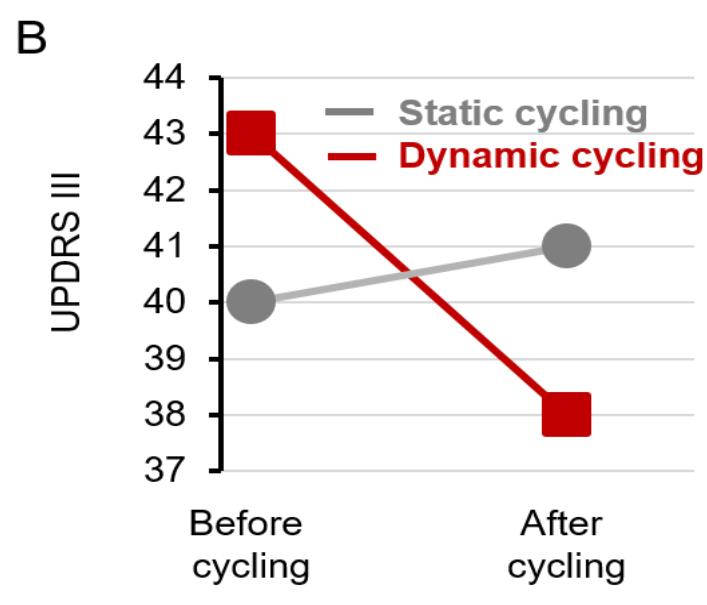
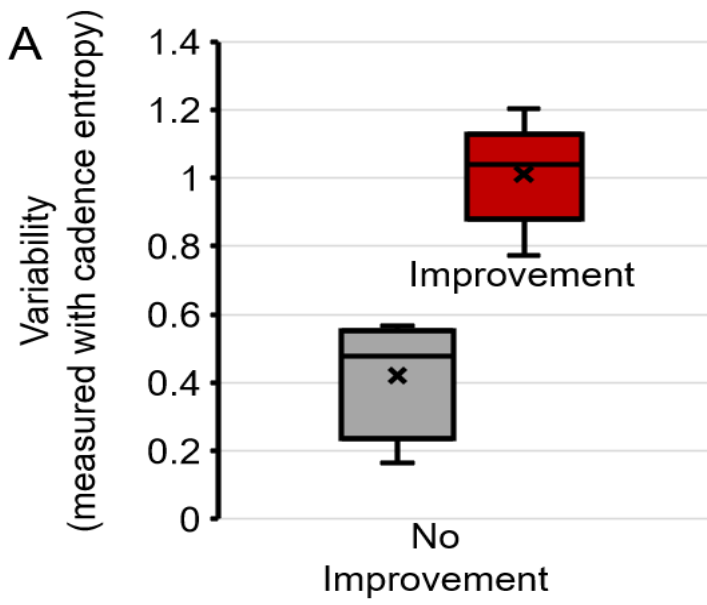
Introduction

- Successful rehabilitation, leading to a favorable course of movement disorders in Parkinson’s disease (PD), is contingent upon frequent, regular, and patient-specific exercise regimen that is customized to the individual needs.
- Lack of access or home-bound status are significant hurdles in delivering effective rehab.
- Our vision is to offer customized rehab using a remotely operated, customized, and remotely monitored technology near or at the patients’ homes.
- The proof of this concept was already established in our laboratory, a technology called dynamic cycling. The highlight of this technology is a stationary bike operating at a rapid speed (cadence) with programmable variability in speed and power/torque hence promoting motor performance superior to traditional motorized bikes (i.e. static cycling).
- Here we present the next step towards our ultimate vision of at-home exercise therapy, a remotely operated dynamic bike.

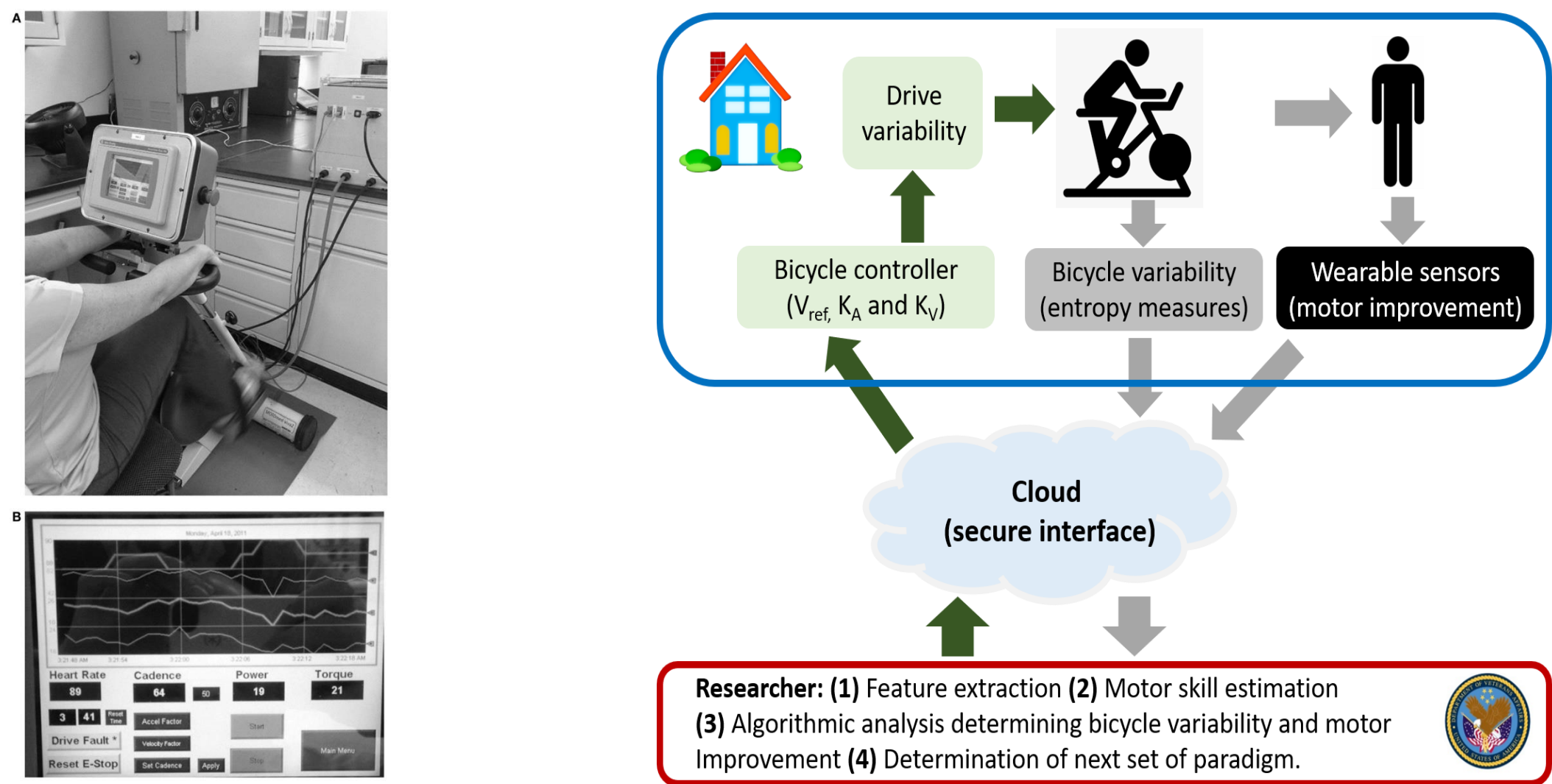
Origin of concept – tandem bike in Parkinson



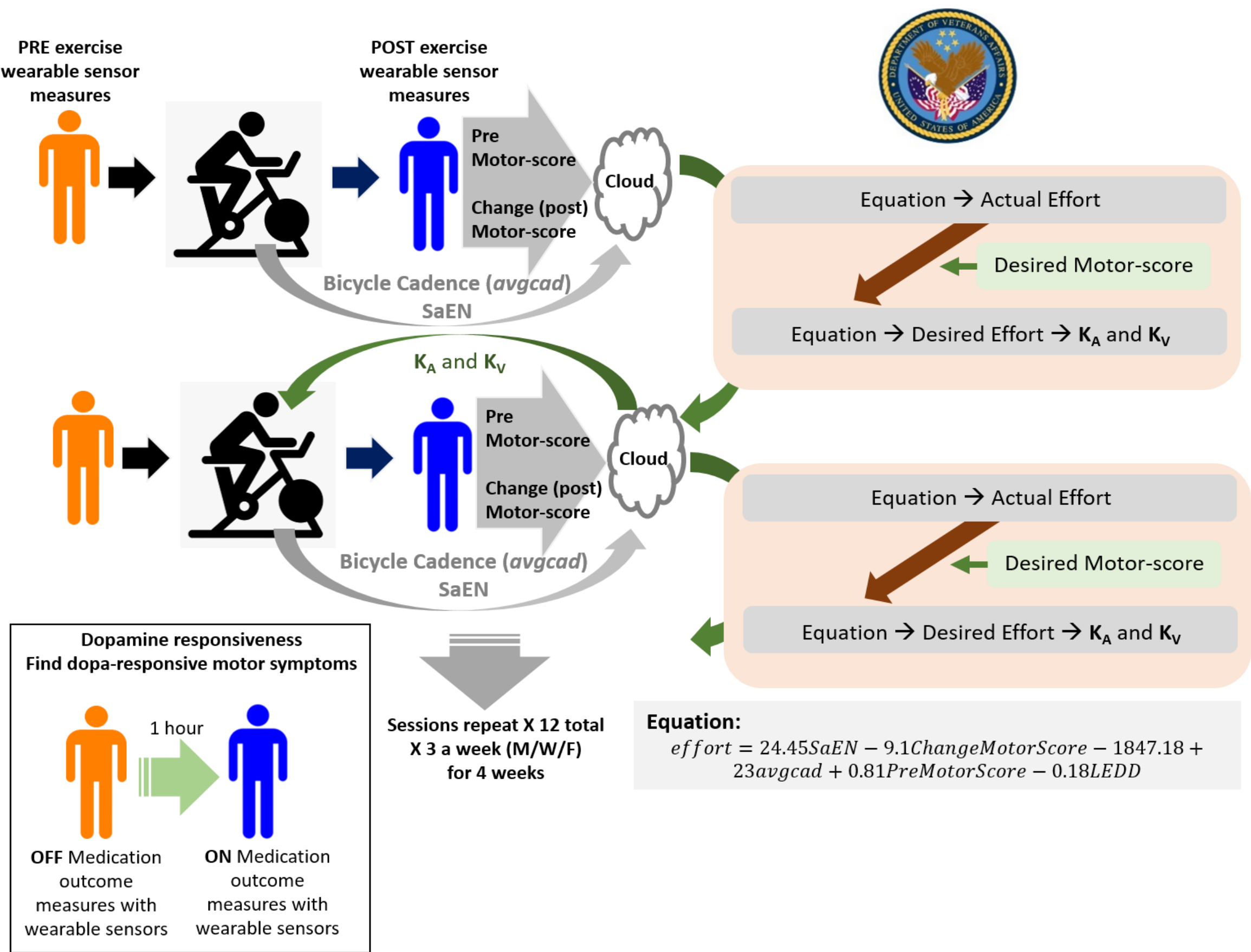
- Parkinson patient did well after tandem biking experience.
- Further study revealed that “force exercise” during tandem biking might determine improvement in Parkinsonian motor symptoms.
- The variability in the forced cycling cadence is much stronger determinant of success after tandem biking (Ridgel et al., 2013).



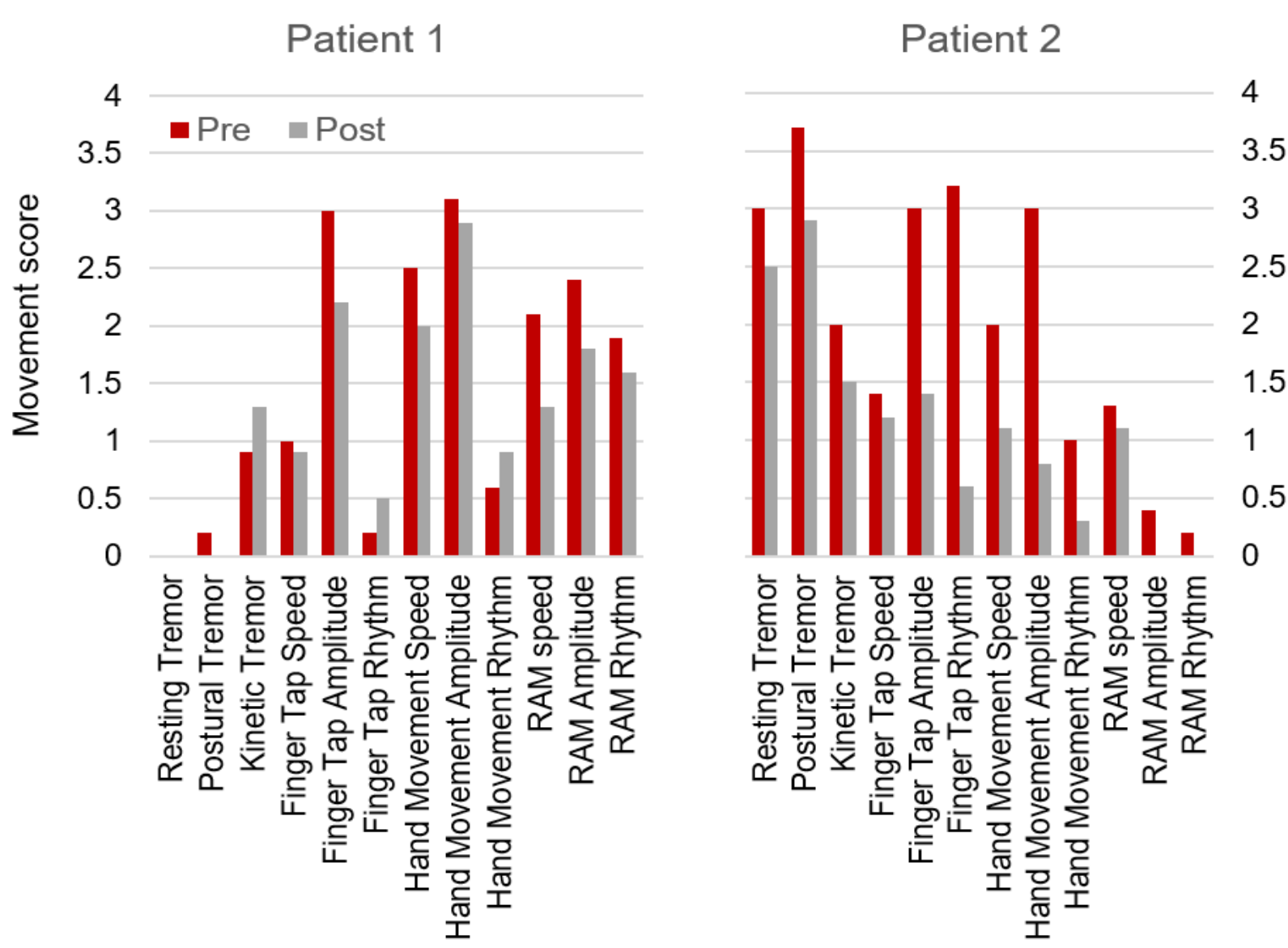
The bike that adapts according to the clinical improvement



- ✓ The patient rides a computerize SMART bike.
- ✓ Wearable sensors measure patients’ Parkinson symptoms in real time.
- ✓ Wearable sensors and bike are both connected to the secure cloud.
- ✓ The cloud is connected to the laboratory computer where artificial intelligence models are generated and implemented for adaptive bike performance in next session.
- ✓ Adapted bike performance is aimed for better control of Parkinson symptoms.



Proof of success



Wearable sensor data from two individuals with PD whose symptoms were assessed before (pre, maroon bars) and after (post, grey bars) 3 sessions of dynamic cycling. Category of motor symptoms are plotted on x-axis while y-axis depict motor scores categorized in finite values ranging between 0-4. The measures of motor scores are standardized in the field and published extensively in the past. (RAM: rapid alternating movement.)

Impact on patient care

