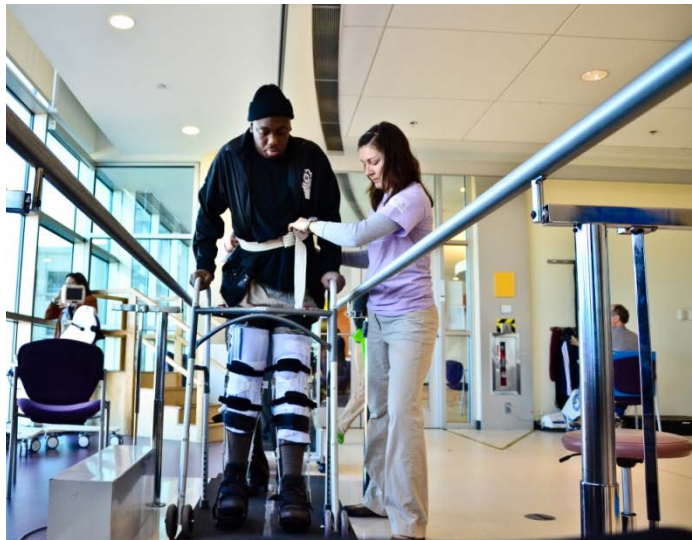


Advances in Rehabilitation

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Disclosures

- I have no conflicts/financial disclosures

Objectives

Become familiar with:

1. Neuroplasticity
2. Activity Based Restorative Therapy principles
3. Technology utilized to improve function

Key Concepts

- Care & Cure
- Hope vs Hype
- Longevity = chronic condition management

Neuroplasticity = the central nervous system's ability to change

The aim of neuroplasticity – optimization of neural network function during development, learning and after injury

Post-injury main neuroplastic interventions are all based on ACTIVITY:

3 interventions:

- Activity Based Restorative Therapy (ABRT)
- Central Nervous System (CNS) stimulation (spinal stimulation, dual stimulation)
- Acute Intermittent Hypoxia

Why Activity?

- “Regular Physical Activity throughout life is important for maintaining a healthy body. Nevertheless, 60% of the global population fails to achieve the minimum physical activity recommendations. **Persons with chronic physical condition are at greater risk** due to inactivity than able-bodied persons because they are often restricted in performing normal everyday activity such as walking, housekeeping, gardening, shopping, and participating in sports” . van- den Berg-Emoms, Bussmann, Stam, (2010)
- “But we already have strong and compelling evidence that physical activity is very close to a magic bullet for good health, and it is important to encourage our patients to be physically active; consider writing prescriptions for physical activity. These could be among the most important prescriptions that we write all day” . Manson, JE (2019)

ACTIVITY BASED RESTORATIVE THERAPY

What is Activity-Based Restorative Therapy?

- Repeated near-normal activity above and below injury level
- Characterized by high intensity practice and task-specificity
- Goal:
 - Restore CNS function
 - Promote neural recovery and regeneration

Compensate vs. Restore

Traditional Therapy

- Activate nervous system above the level of the lesion
- Low intensity practice (1 hour per day)
- Non-patterned movements
- Compensates for loss function
- Uses compensatory devices

ABRT

- Activate nervous system above and below the level of the lesion
- High intensity practice (2-5 hours per day)
- Non-patterned and patterned movements
- Restores lost function
- Minimizes or eliminates compensatory devices

Key Components of ABRT

1. Functional Electrical Stimulation (FES)
 2. Locomotor Gait Training
 3. Weight Bearing
 4. Massed Practice
 5. Task-Specific Practice
- + Aquatherapy, Vibration

1. FES - RT 300 SL



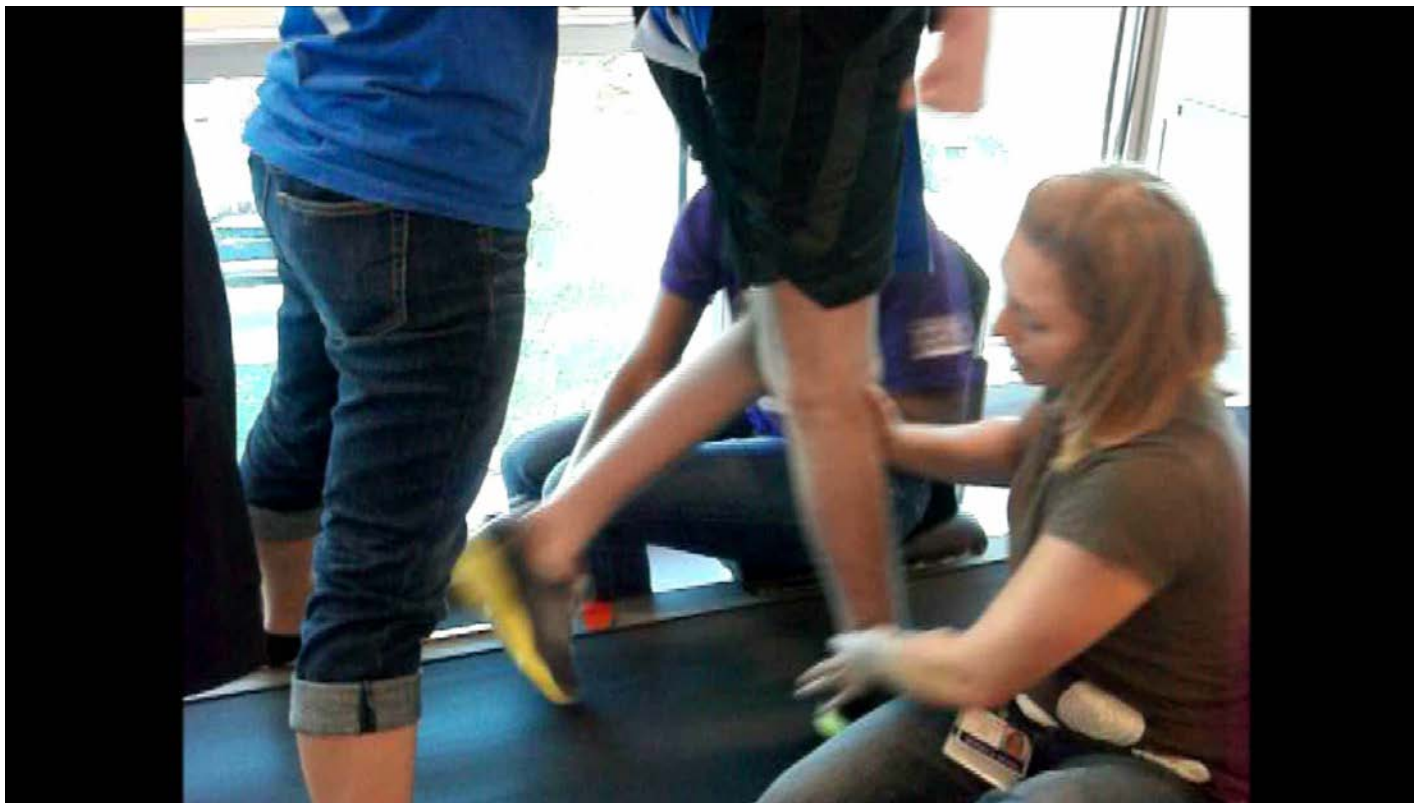
2. FES – RT 300 SA



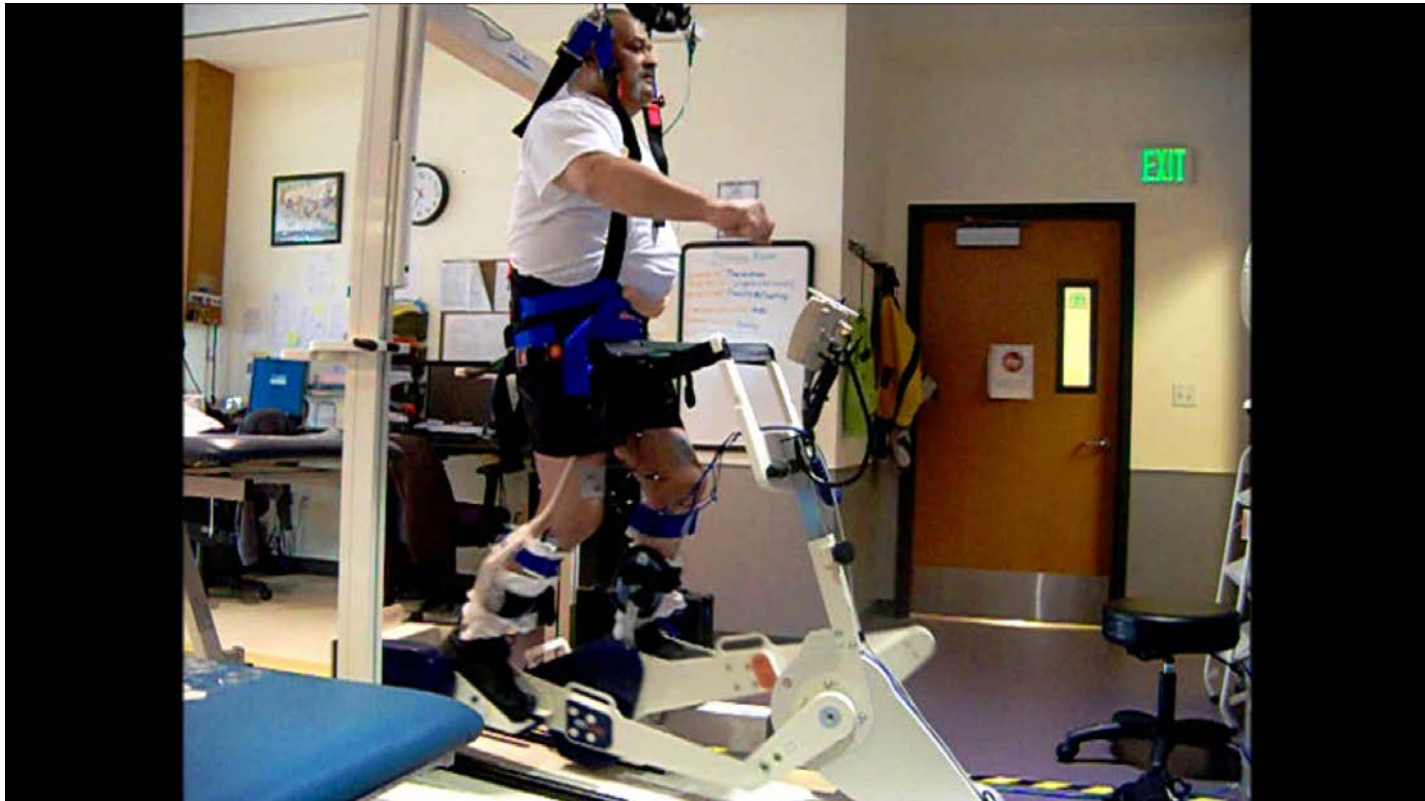
There's more to it



2. LOCOMOTOR GAIT TRAINING



3. WEIGHT LOADING - RT 600



WEIGHT LOADING - Stander



4. MASSED PRACTICE



Repetitions in traditional rehab

- 312 therapy sessions in post-stroke rehab
- Average duration (min) 36 min
- UE (functional movement) 32 min
- LE (functional movement) 6 min
- Gait (steps) 357
- Transfers 11

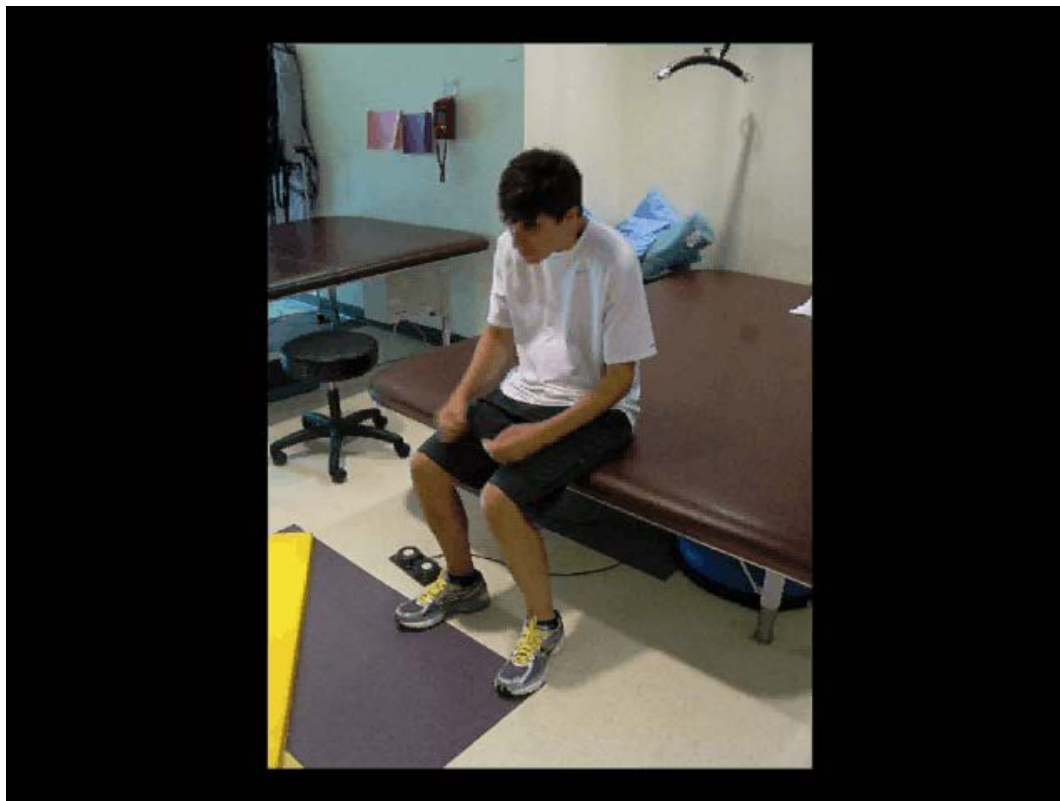
NOT ENOUGH!

- “Amount of practice...is small compared with animal models...Current doses...during rehabilitation are not adequate to drive neural reorganization needed to promote function post-stroke optimally.”

5. TASK-SPECIFIC PRACTICE



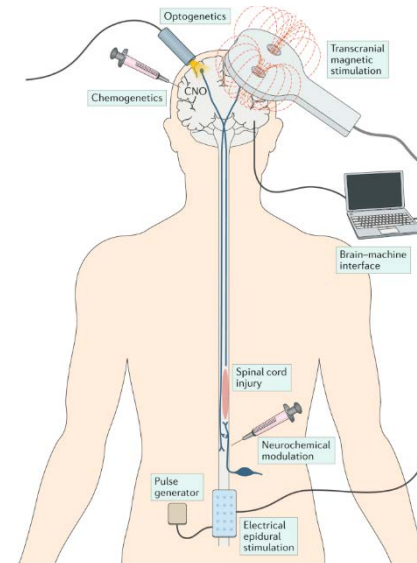
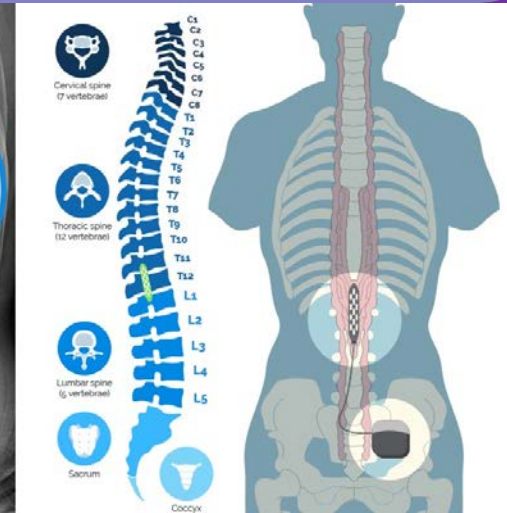
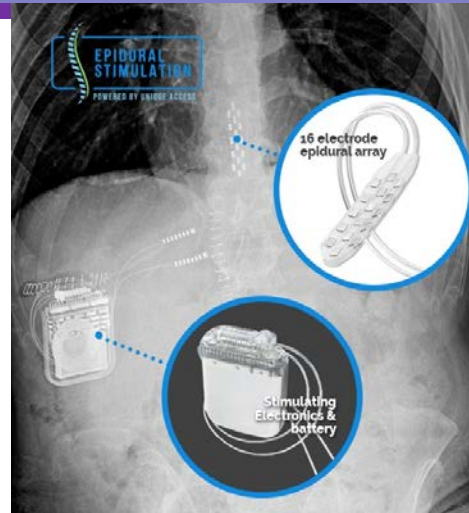
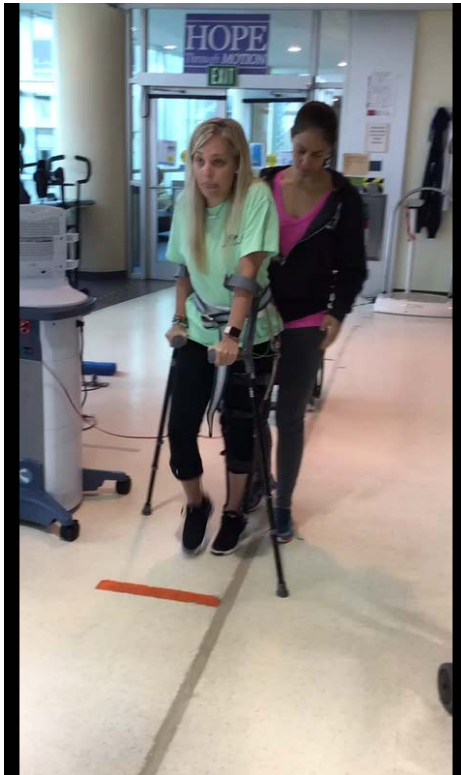
TASK-SPECIFIC PRACTICE



CNS STIMULATION

CNS stimulation

1. Spinal transcutaneous
2. Spinal epidural
3. Dual spinal and cortical



ACUTE INTERMITTENT HYPOXIA

Acute Intermittent Hypoxia

- Training under repeated exposure to low oxygen enhances neuroplastic changes by enhancing serotonin release.

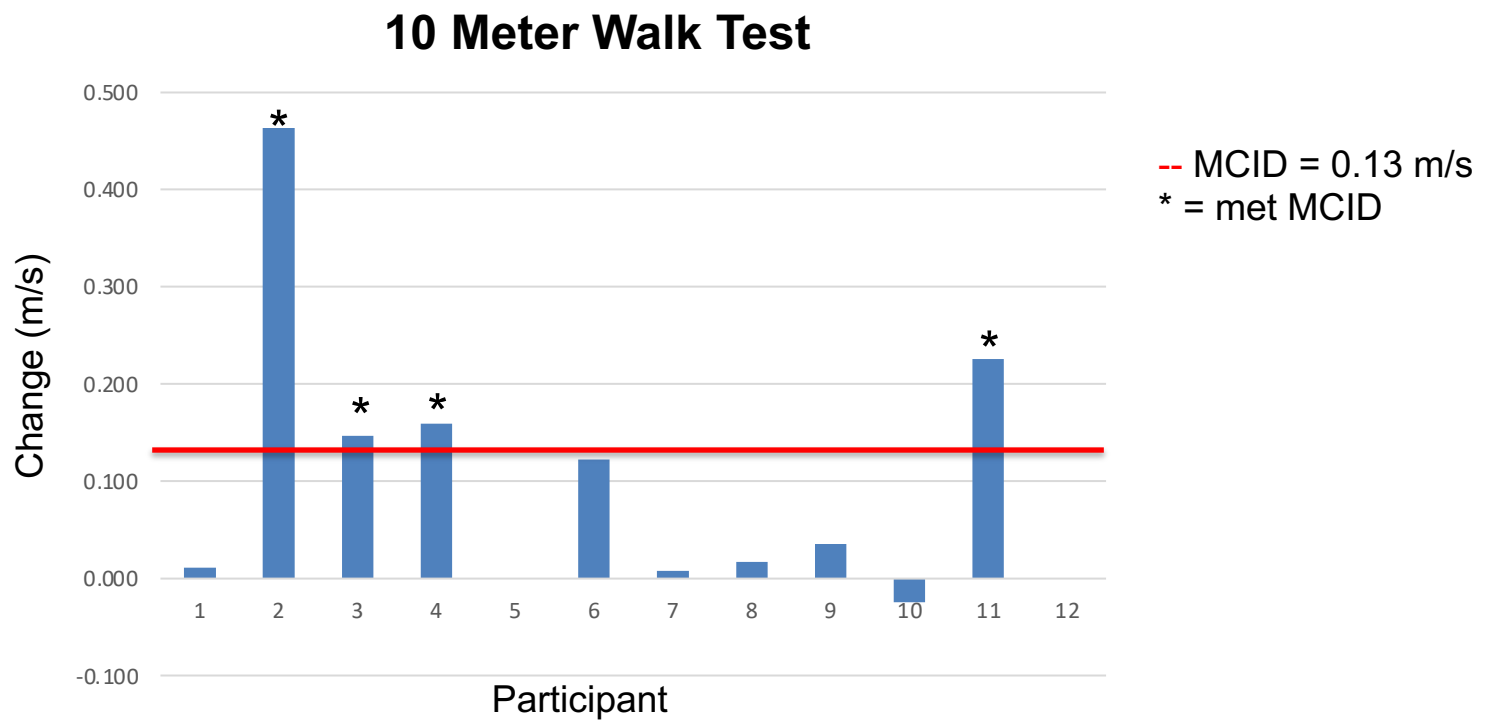


HYP-123 Generator

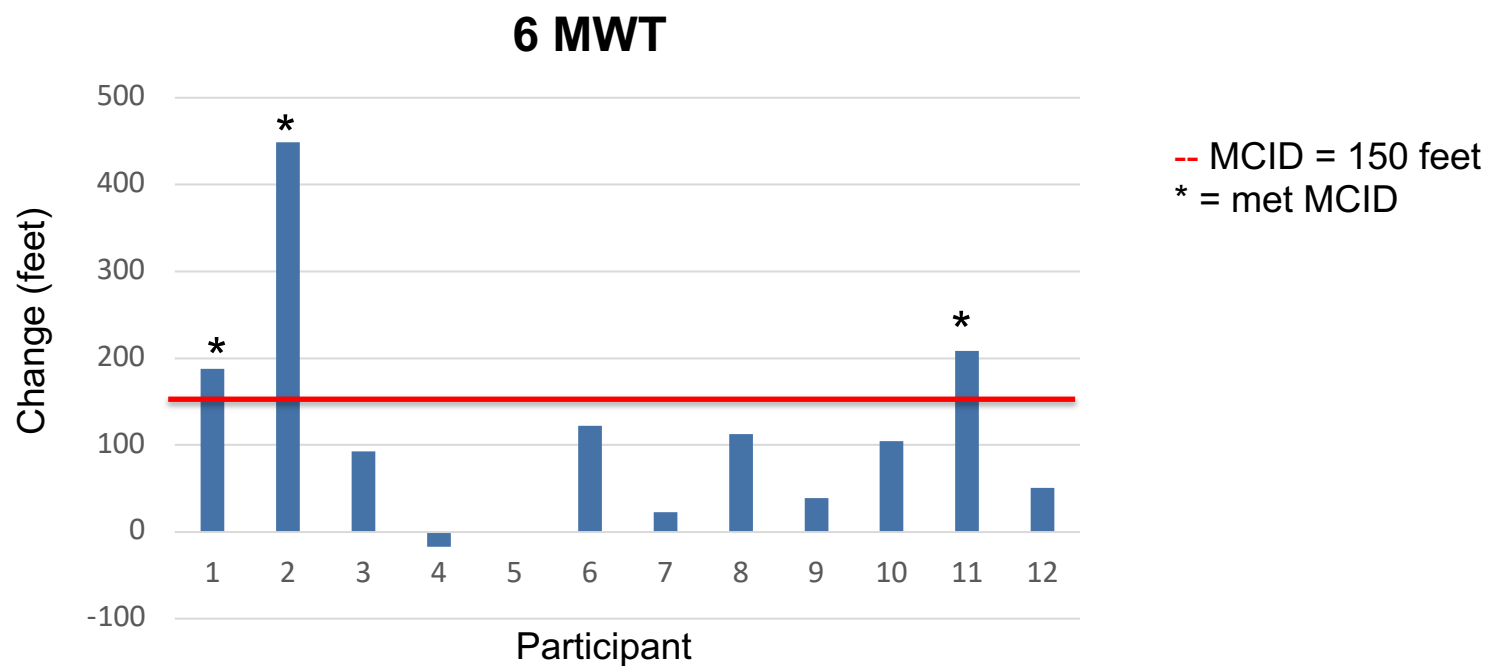


Non-re-breather mask
+ neoprene sleeve

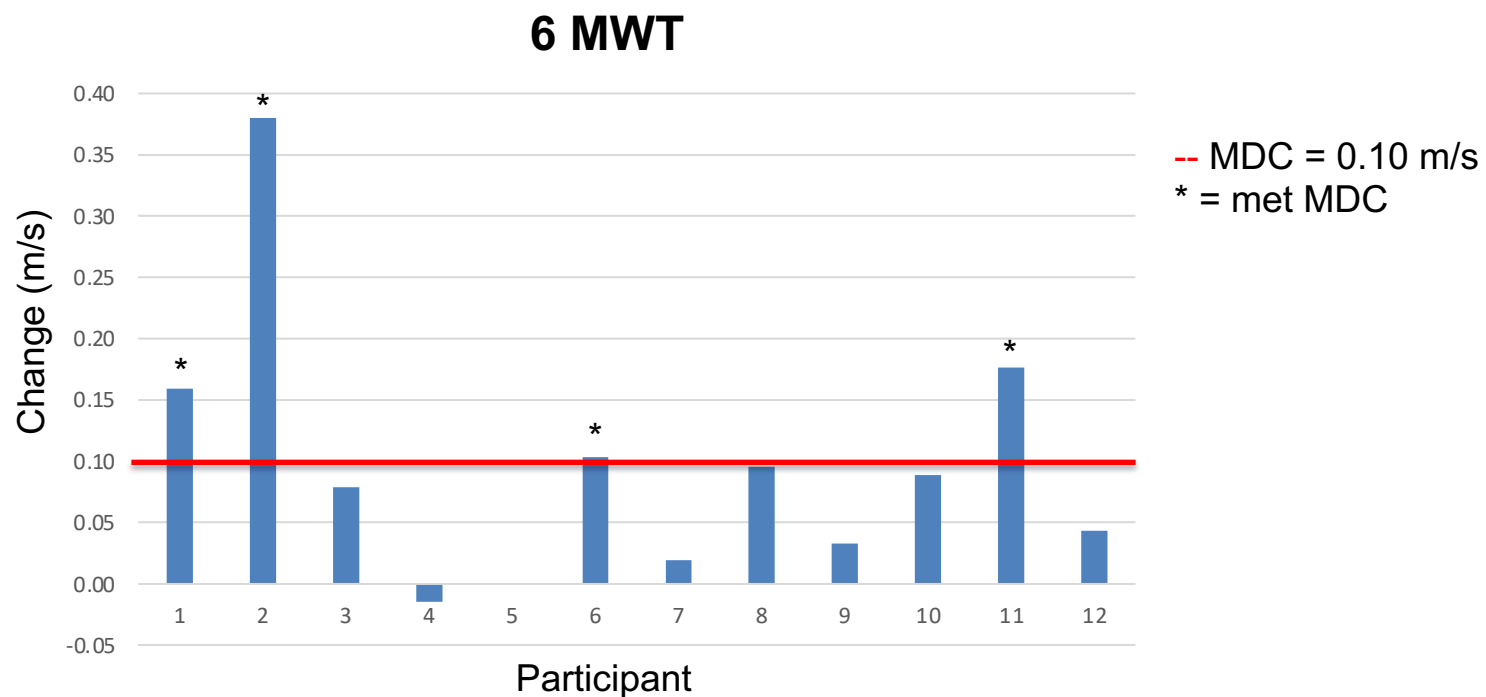
Outcomes



Outcomes



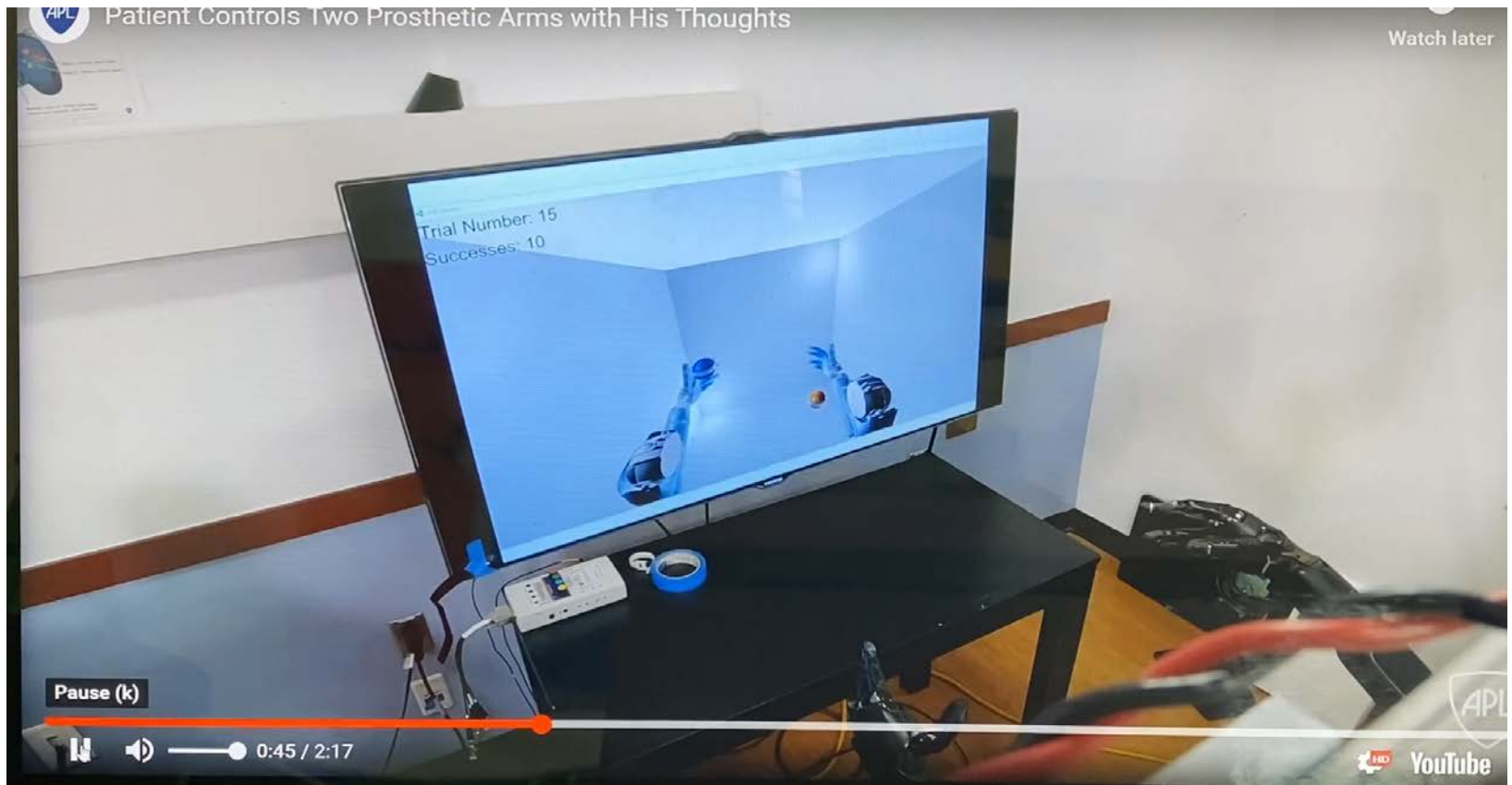
Outcomes





TECHNOLOGY TO MAKE IT WORK

Brain Computer Interface



Robotics Myomo



Amadeo



Armeo



Exoskeletons- EKSO



A person is silhouetted on a surfboard, riding a wave. The ocean is calm with a small wave breaking in the foreground. The sky is a mix of orange, yellow, and blue, suggesting a sunset or sunrise. The overall mood is serene and contemplative.

Nothing will ever be attempted if all possible objections must be first overcome

Samuel Johnson

Knowing is not enough; we must apply. Willing is not enough; we must do.

Goethe

2020 RNDS



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Long-term Treatments for Preventing Relapses