

Use of Oscillating Motors in the Design and Fabrication of an Upper Extremity Spasticity Control Orthosis

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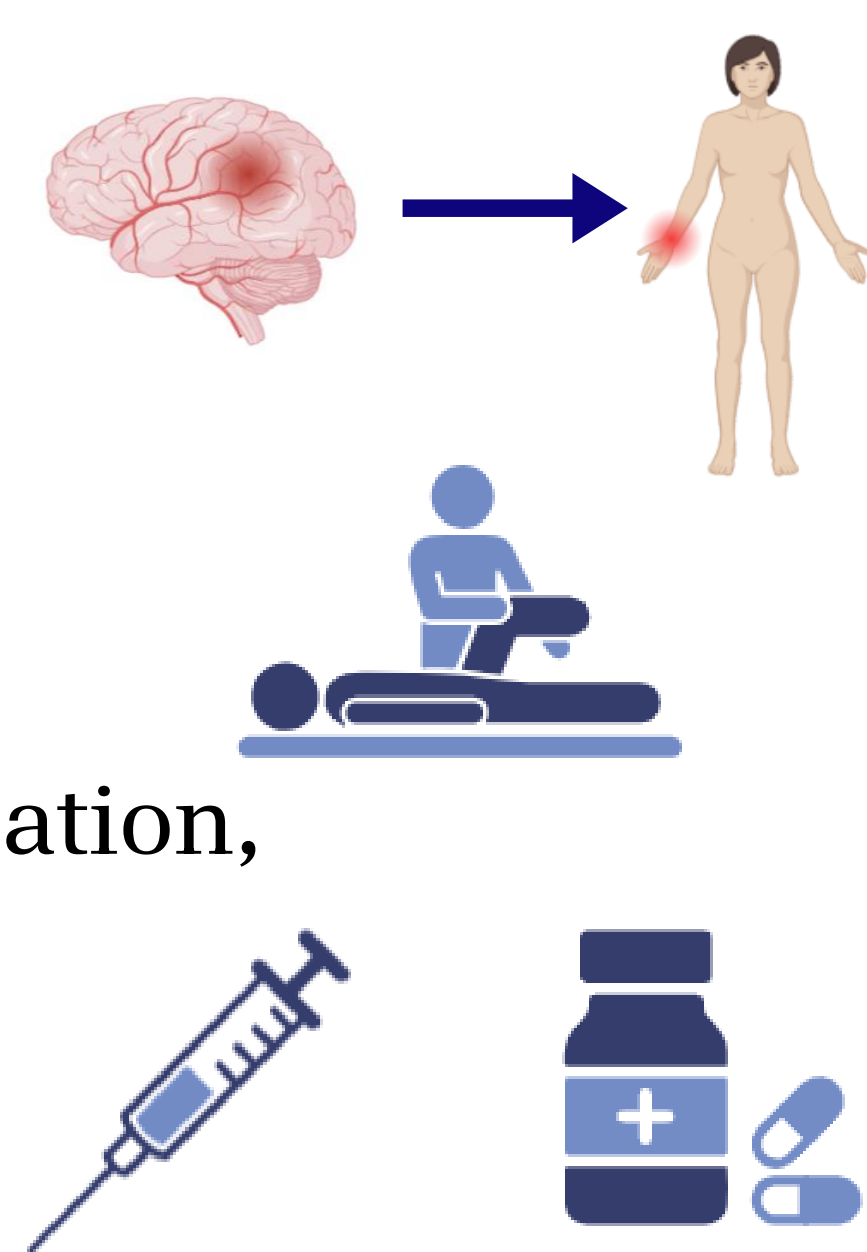
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Introduction

- Post-stroke spasticity
 - Occurs in 30-40% of survivors¹
- Consequences
 - Pain, contractures, decreased function and quality of life¹
- Current management
 - Physical modalities, oral medication, and chemodenervation²
- Persistent gap
 - Limited functional recovery



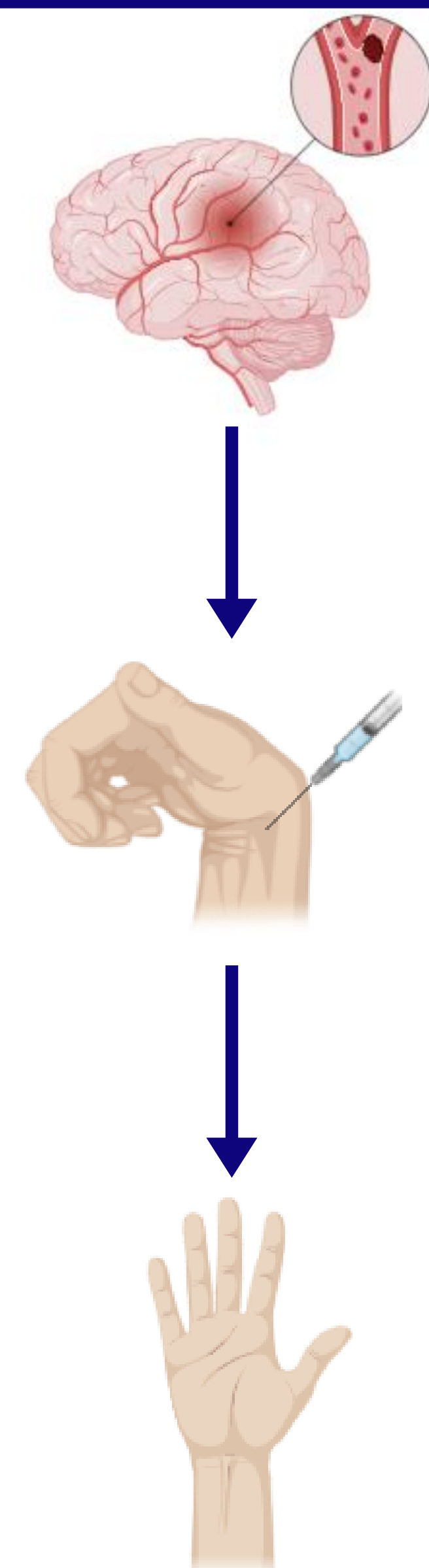
Primary Aim

This single-participant case study assesses a custom passive range-of-motion oscillating wrist orthotic designed to reduce tone and improve function as an adjunct to spasticity management.

Case Description

Participant Profile

- 67-year-old female
- Right-hand dominant, had right-sided stroke in 2011
- Chronic left spastic hemiparesis
- Restricted upper extremity function on left side
- Notable benefit from stable botulinum toxin A injections but with additional participant goals



Participant Goals

- Improve fine motor tasks for activities of daily living (e.g., buttons, zippers)
- Increase ability to sustain grip
- Reduce dropping of objects
- Increased ease of opening hand

Study Protocol

Table 1. Study timeline showing intervention and washout periods in relation to toxin level, which naturally waned over 8-week period.

Study Timeline	
Toxin Injection	Injection delivered 5/19/25 prior to study start
Week 1	Intervention: Fingers Free
Week 2	Washout
Week 3	Intervention: Fingers Extended
Week 4	Washout
Week 5	Intervention: Fingers Free
Week 6	Washout
Week 7	Intervention: Fingers Extended
Week 8	Washout
Toxin Injection	Injection delivered 9/8/25 following study completion

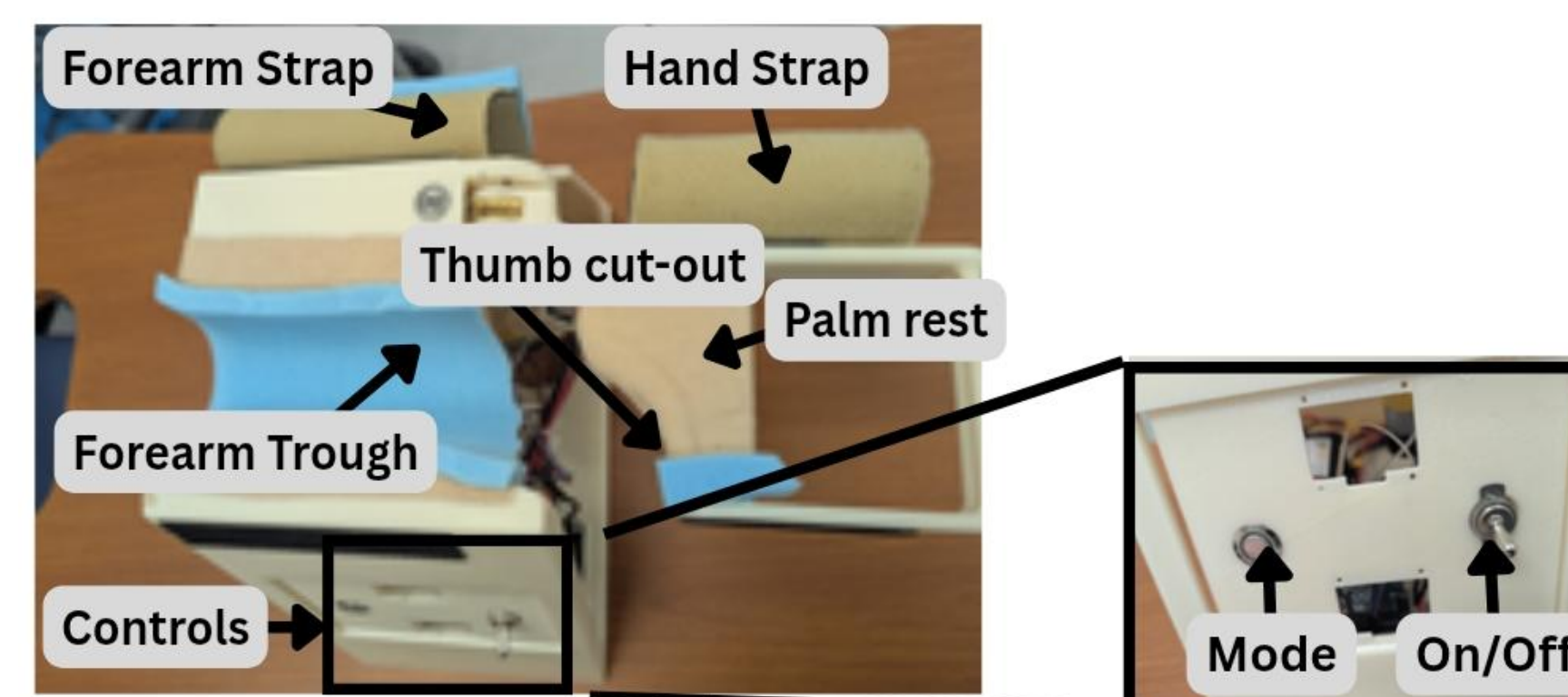


Figure 1. The final orthosis design (fingers-free mode) is depicted to the left, demonstrating controls and limb placement.

Results/Outcomes

Participant Diary Entries

Improved comfort

...Fingers feel looser
...Easier to straighten out [hand] with arm resting on table
...Hand is less claw-like



Improved household function

...Easier to grip drinking glasses
...Easier to pick up objects



Regression during washout

...Increased difficulty with grasping food and utensils
...More challenging to wash hair with maximal use of hand

Figure 3. Participant engaged in orthosis use during her on-site visit.

Primary Takeaway

This case study demonstrates that use of a passive range of motion oscillating wrist orthosis produced positive outcomes in grip, dexterity, and function for an individual with post-stroke spasticity.

Results/Outcomes

Table 2. Participant left-hand response to orthosis use per OT assessment.

Phase	Time	Dexterity	Grip
Fingers Free	Week 1 - 2	+2.7 ↗	-1.0 ↘
Fingers Extended	Week 3 - 4	+3.0 ↗	-1.1 ↘
Fingers Free	Week 5 - 6	+1.3 ↗	+1.7 ↗
Fingers Extended	Week 7 - 8	+3.0 ↗	+1.3 ↗

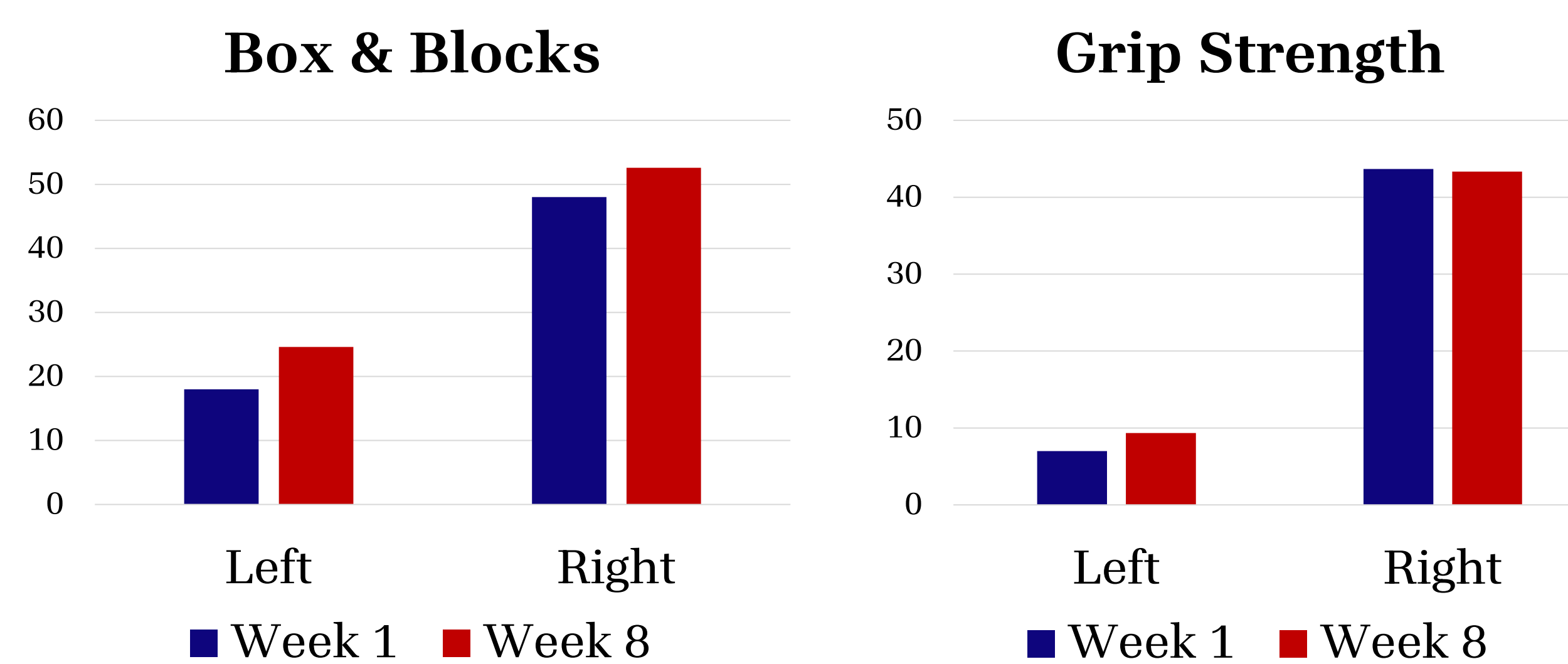


Figure 2. Patient's change across study period for left and right hands.

Discussion

- First known exploration of benefits of passive oscillation on upper limb spasticity
- Improvements were independent of finger position or toxin effects, which included
 - Strength
 - Fine motor coordination
 - Increased functional integration
- Participant found device comfortable and easy to use
- Further evaluation of this device is needed to determine feasibility and reproducibility of this orthotic for addressing similar functional needs



References & Video Demos

