# A Brake-based Over-ground Gait Rehabilitation Device for Increasing Paretic Propulsive Force

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## Background

- Propulsion force is a key contributor in achieving forward progression while walking [1-2].
- Stroke often reduces the ability to produce propulsion force equally between the two legs, causing propulsion force asymmetry [2].
- Reducing propulsion force asymmetry is correlated with positive walking outcomes after stroke [2-3].

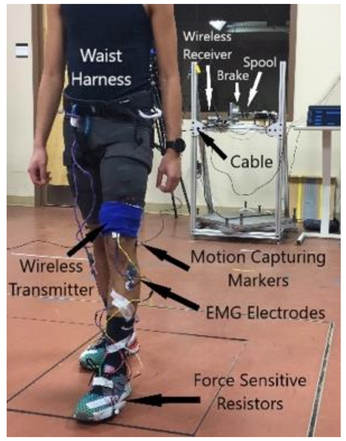
## Objectives

To present a pilot study of the Gait Propulsion Trainer (GPT), a device designed to unilaterally alter propulsion force.

## Methods

Device Components:

- A cable spool attaches to a waist-level stand.
- The cable attaches to a belt worn around the hips.
- A rotary brake periodically resists the spool's rotation.
- Force sensitive resistors beneath the shoes send wireless signals to turn the rotary break on.



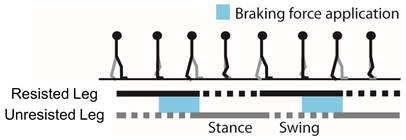

Pilot Participants:

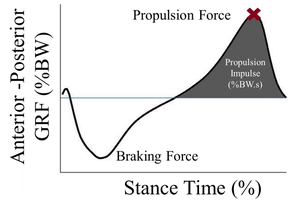
- 50-year-old female with stroke (19.8 N BL Peak Propulsion).
- 30-year-old male healthy control (133.3 N BL Peak Propulsion).

Table 1. Experimental Design.

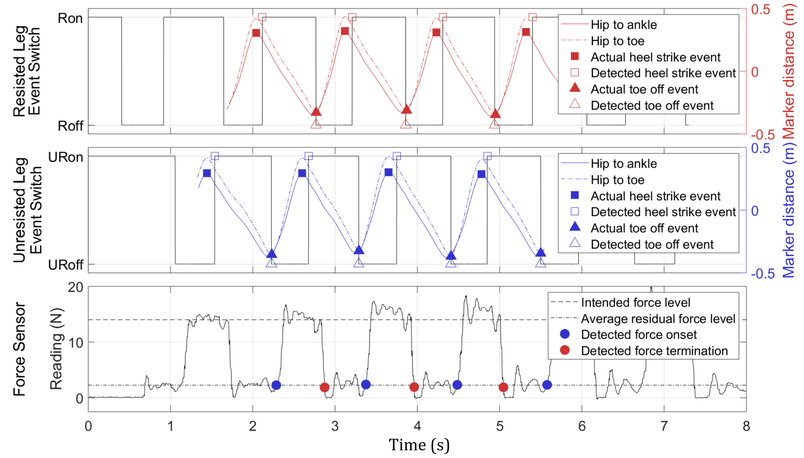
| Condition | Subject Wearing GPT | Control GPT Resistance Level | Participant with Stroke GPT Resistance Level |
|---|---|---|---|
| Baseline (BL) | No | Not Applicable | - |
| 0 % BL | Yes | 0 N | 0 N |
| 20% BL | Yes | 26.7 N | 4.5 N |
| 30% BL | Yes | 40.0 N | 5.8 N |
| 40% BL | Yes | 53.3 N | 8.0 N |
| 50% BL | Yes | 66.7 N | - |
| 60% BL | Yes | 93.3 N | - |
| Post-Training | Yes | 0 N | 0 N |

## Intended Device Operation



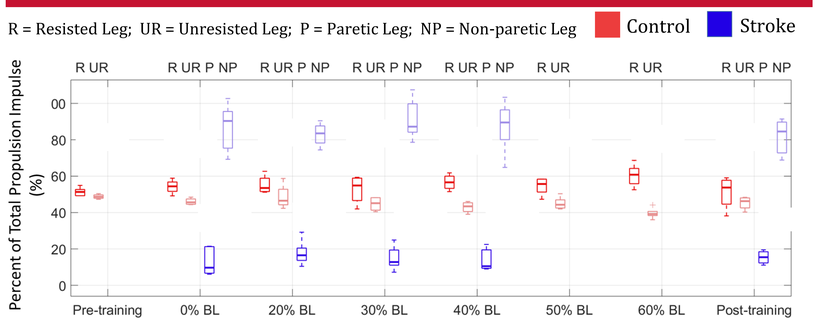

## Actual Device Operation




A single trial of the healthy participant demonstrates the timing of GPT resistance application in the gait cycle.

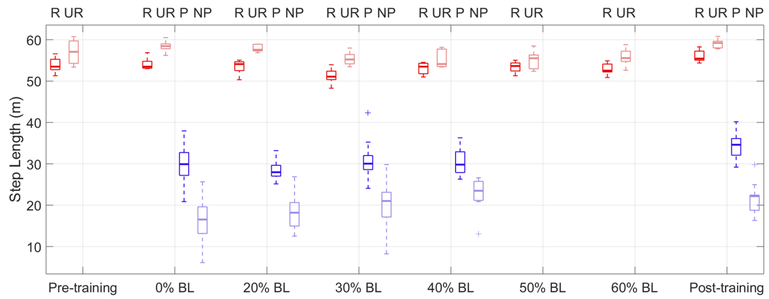
## Results

R = Resisted Leg; UR = Unresisted Leg; P = Paretic Leg; NP = Non-paretic Leg




- Resisted leg propulsion impulse of the healthy participant increased with higher GPT resistance.
- Paretic leg propulsion impulse is reduced in the stroke participant's first exposure to GPT resistance.

## Results




- Step length was not largely altered on either leg throughout the experiment for the healthy control.
- Step length of the non-paretic leg of the stroke participant increased as GPT resistance increased, producing a surprising result of increasing step length symmetry.

## Conclusions

- This pilot experiment allowed us to verify the accuracy of the timing of GPT resistance.
- Propulsion impulse symmetry was successfully altered in the healthy control participant.
- Propulsion impulse symmetry was reduced upon GPT resistance exposure in the stroke participant, but this reduction did not scale with resistance magnitude.
- Step length symmetry in our stroke participant increased as GPT resistance magnitude increased.

## Acknowledgements

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## References

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