

# Visuomotor ankle force training in individuals with spastic cerebral palsy compared to their typically developed peers

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## Cerebral Palsy

- ↓ muscle volume
- ↓ muscular strength
- ↓ appropriate muscle pattern



## ***Aim***

Investigate the impact of six weeks of visuomotor tracking tasks on ankle control, voluntary activation capacity and strength in young adults with spastic cerebral palsy compared to their typically developed peers.

## ***Hypothesis***

Ankle visuomotor tracking will elicit improvements in:

- a) Force control in both groups.
- b) Voluntary activation capacity and strength in young adults with spastic cerebral palsy.

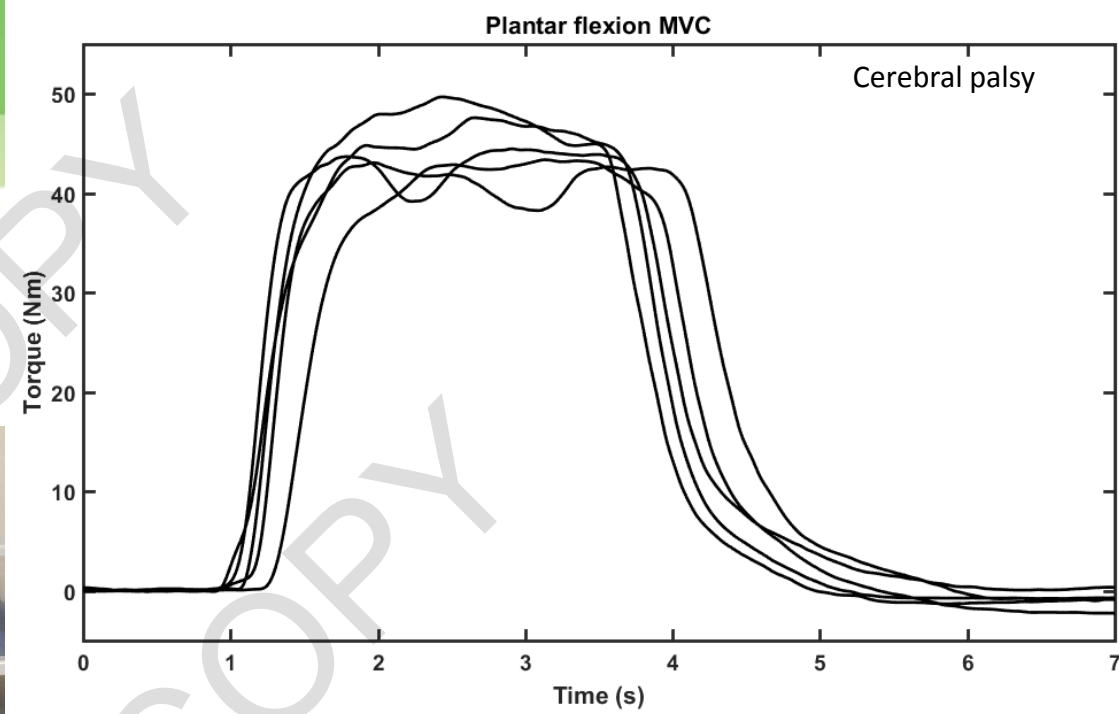
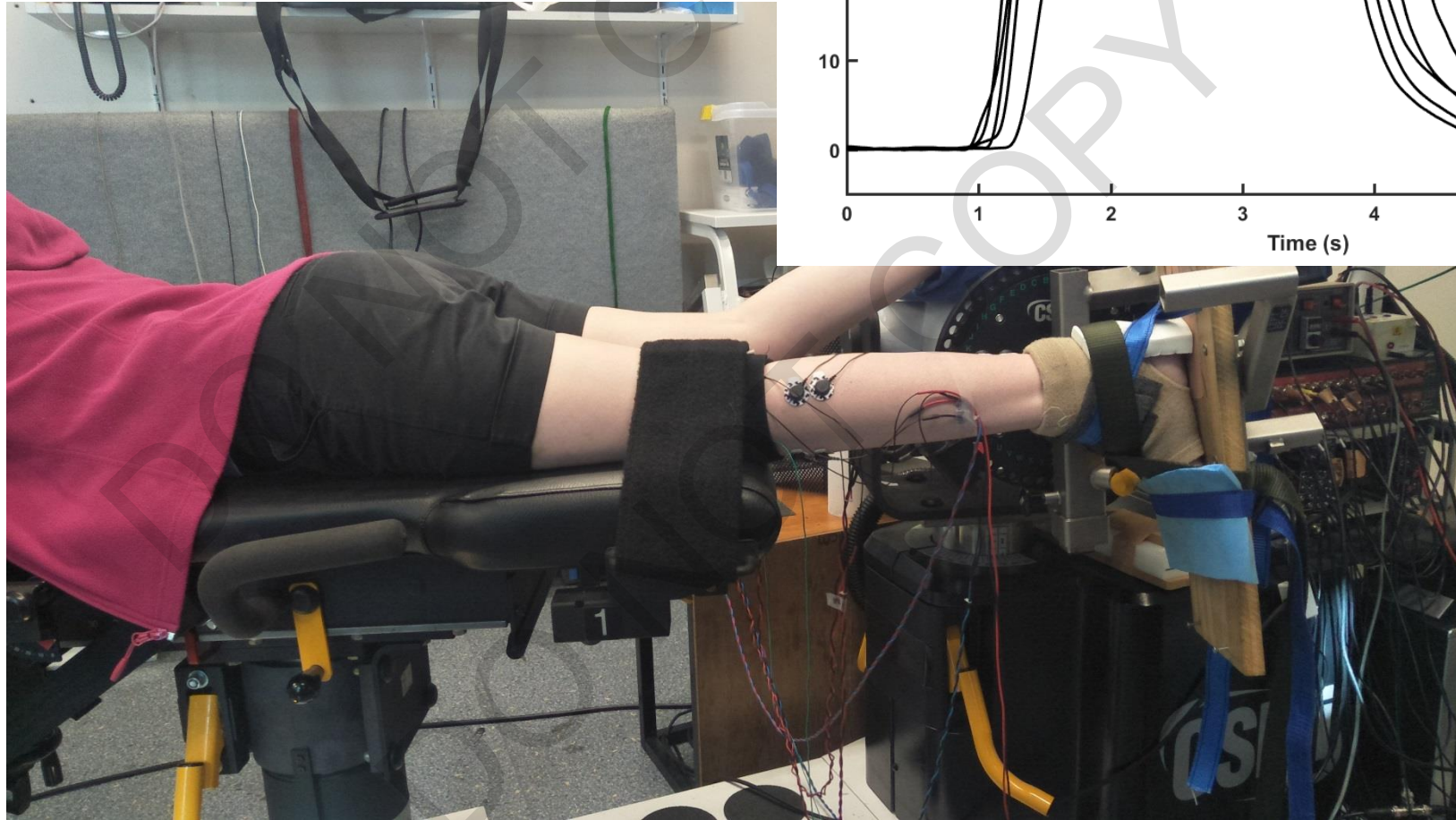
# Participants

|                               | Spastic Cerebral Palsy     | Typically Developed | p    |
|-------------------------------|----------------------------|---------------------|------|
| <b>n</b>                      | 5                          | 9                   | -    |
| <b>Age (yrs)</b>              | 22 ± 2                     | 23 ± 6              | 0.46 |
| <b>Sex (M/F)</b>              | 2/3                        | 2/7                 | -    |
| <b>Diagnosis</b>              | hemiplegia=3<br>diplegia=2 | -                   | -    |
| <b>GMFCS</b>                  | I=4<br>II=1                | -                   | -    |
| <b>BMI (kg/m<sup>2</sup>)</b> | 23.4 ± 2.8                 | 25.9 ± 5.6          | 0.27 |

mean ± SD



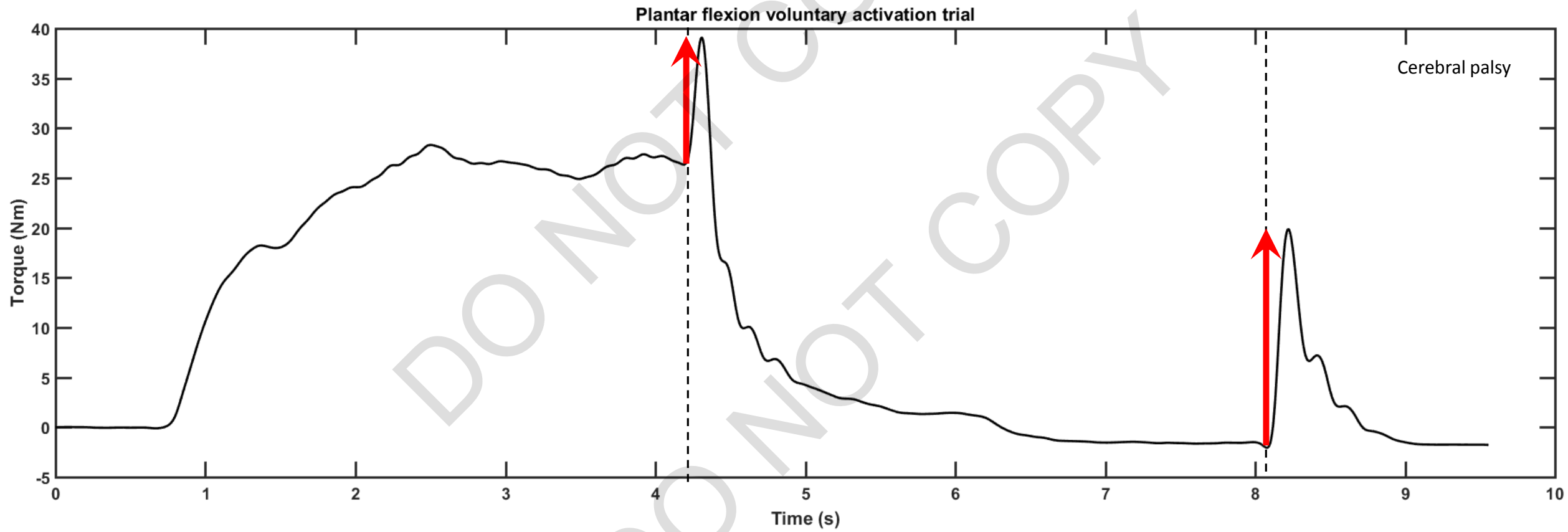
# Strength



# Voluntary Activation

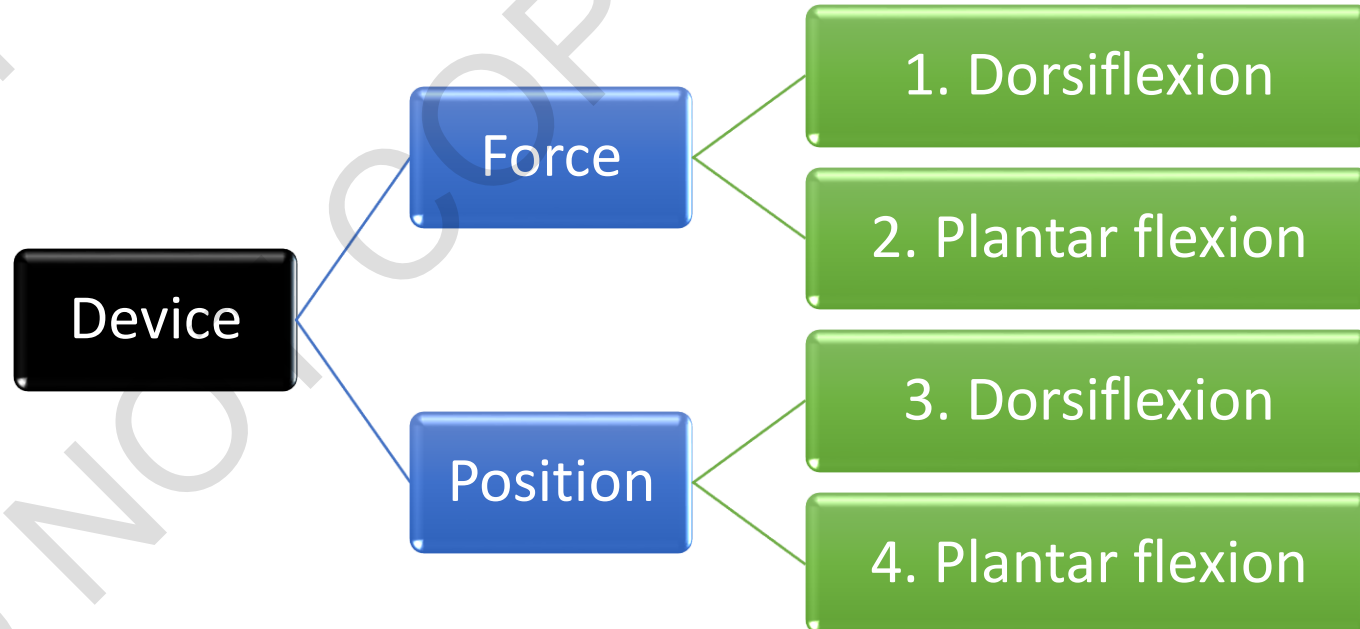
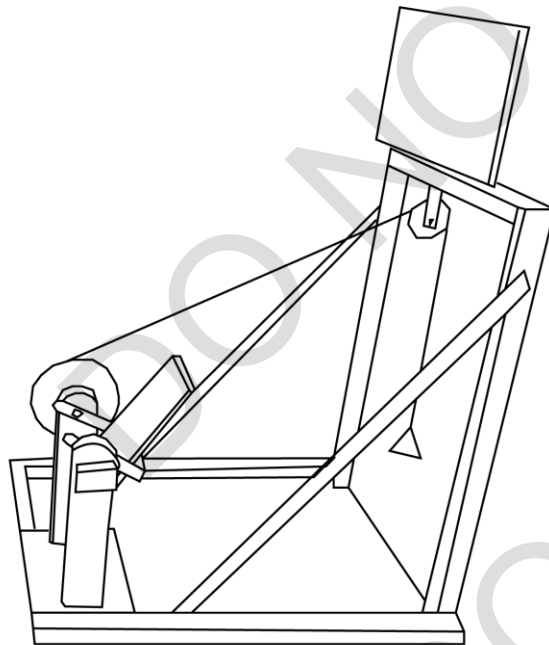
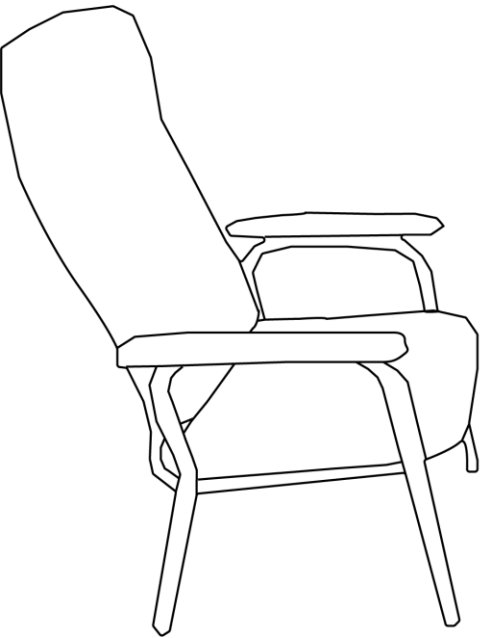
- Interpolated twitch technique (ITT)
  - Non-invasive
  - Excitation of motor units
- Peripheral nerve stimulation
  - Single twitch stimulation
  - Supramaximal
  - Tibial nerve



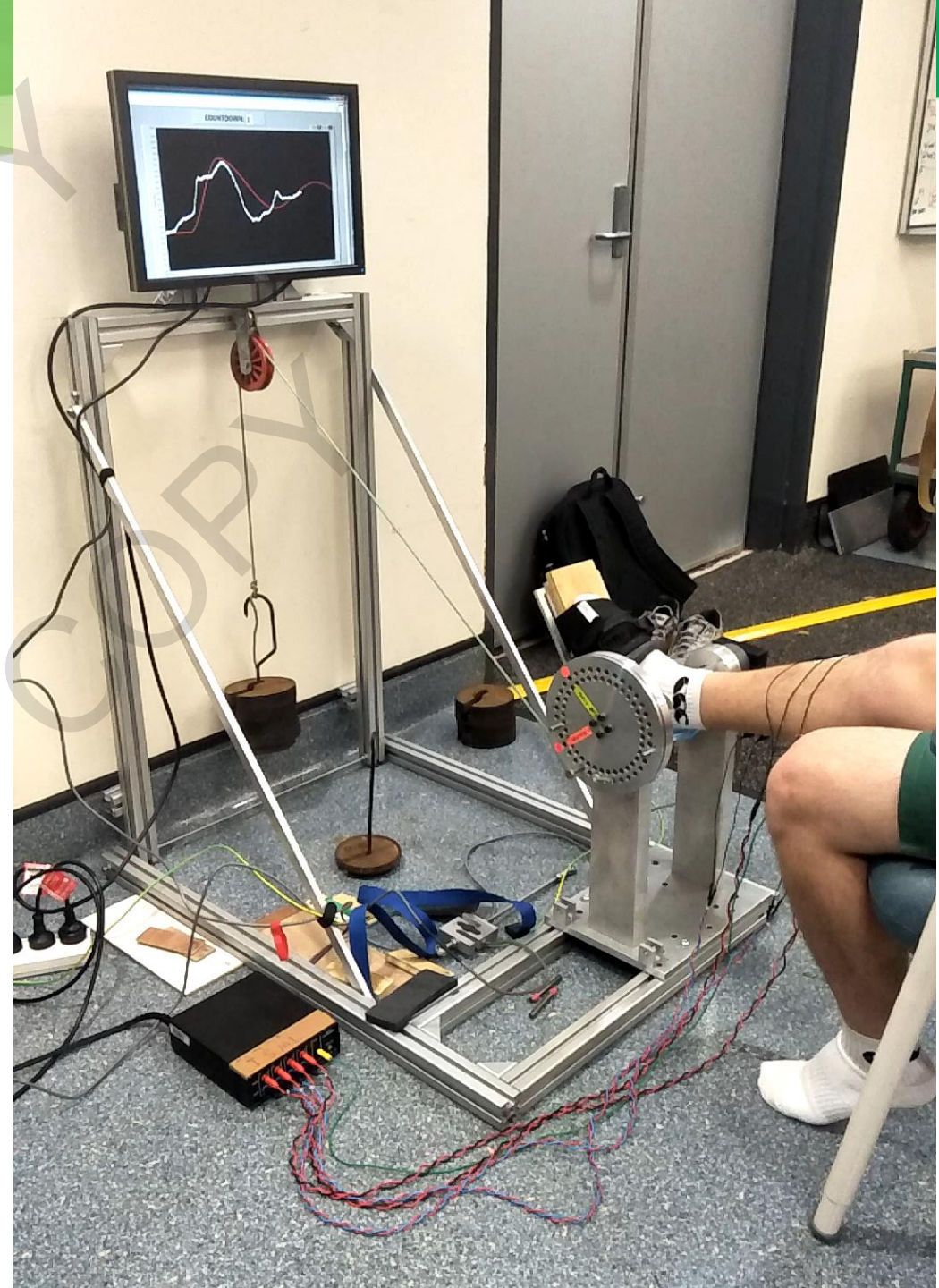
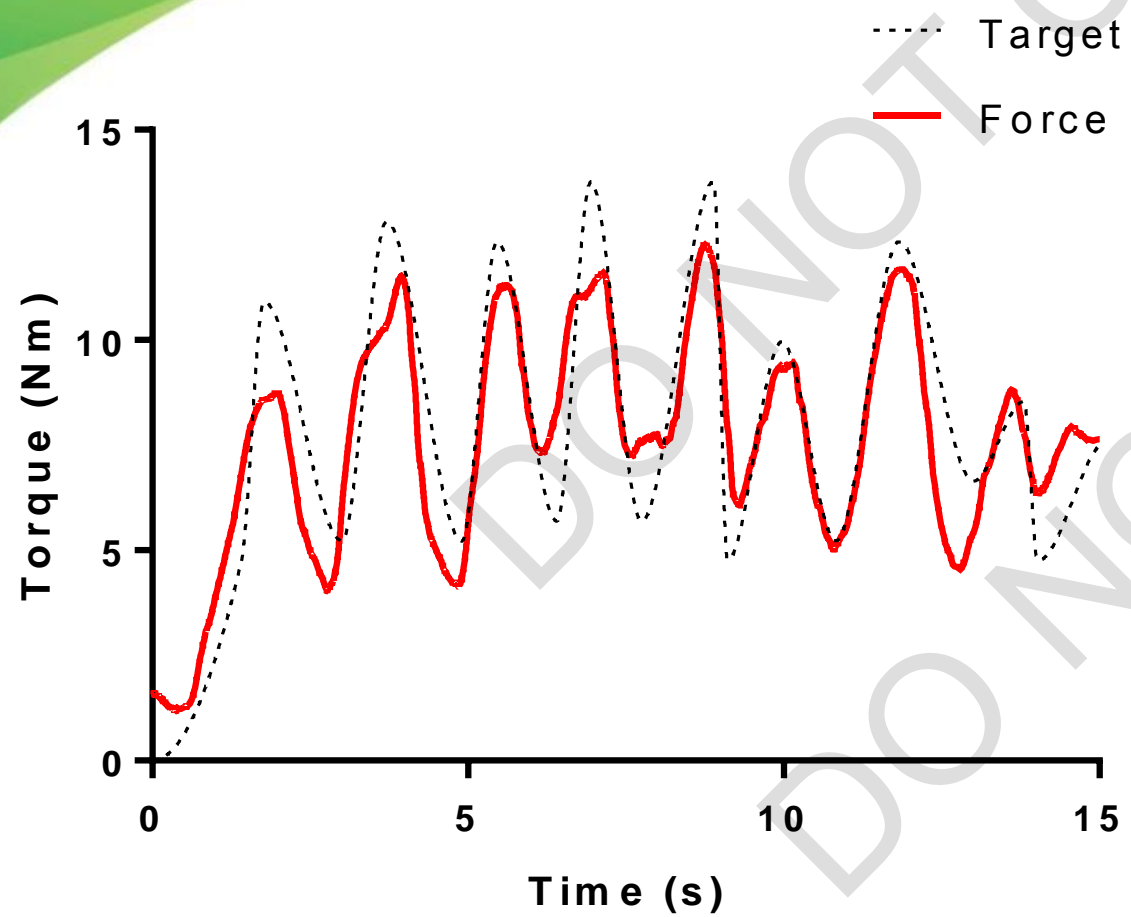




# Ankle Visuomotor Control Task

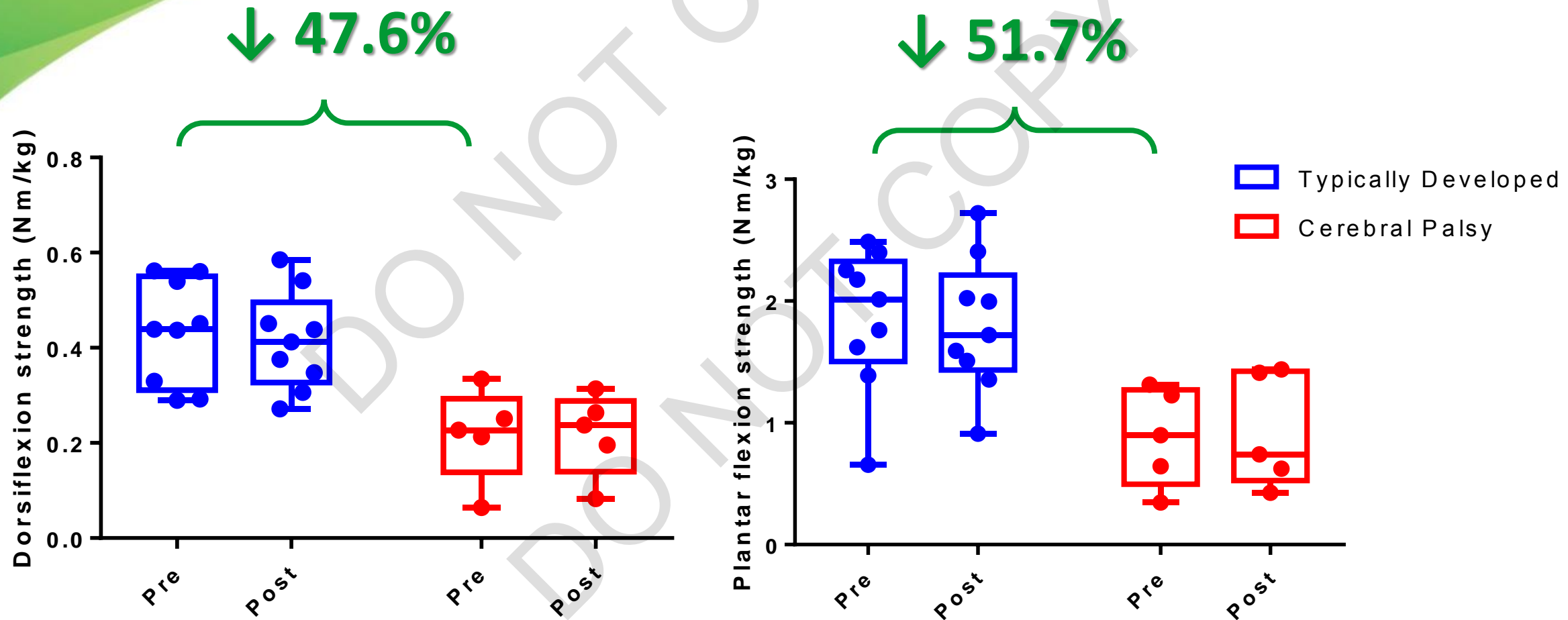




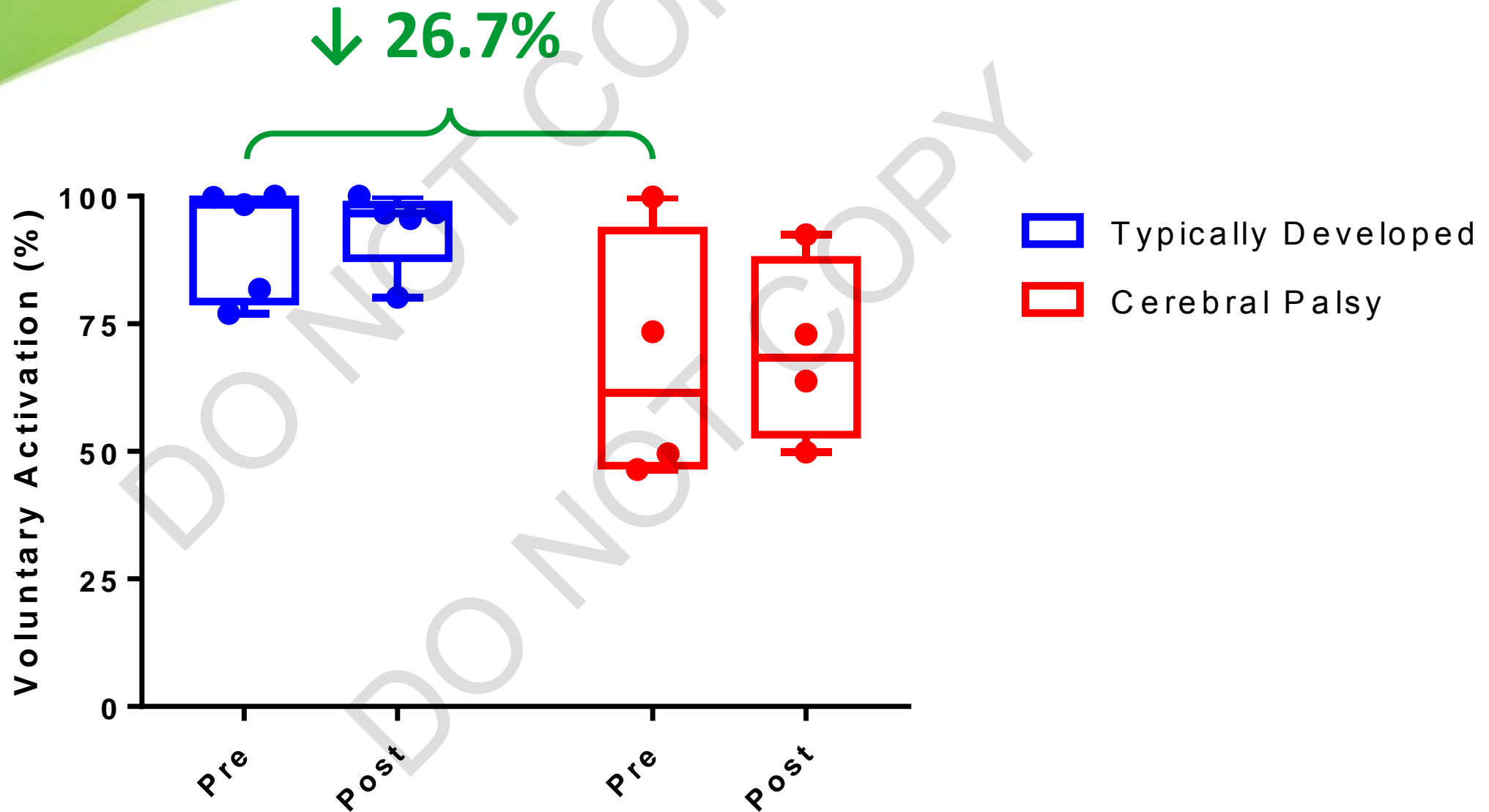


|                        | Testing   | Training                                    |
|------------------------|---|---|
| <b>Leg</b>             | Most affected                                   | Most affected                               |
| <b>Frequency</b>       | Pre-training, post-training                     | 3days/week over six consecutive weeks       |
| <b>Difficulty</b>      | Low (0.3Hz)<br>Moderate (0.6Hz)<br>High (0.9Hz) | 0.4Hz<br>↑0.1Hz/week if accuracy target met |
| <b>Trial length</b>    | 60s   | 60s   |
| <b>Rest period</b>     | 60s   | 30s   |
| <b>Trials per task</b> | 1x low<br>1x moderate<br>1x high                | 4   |

# Strength



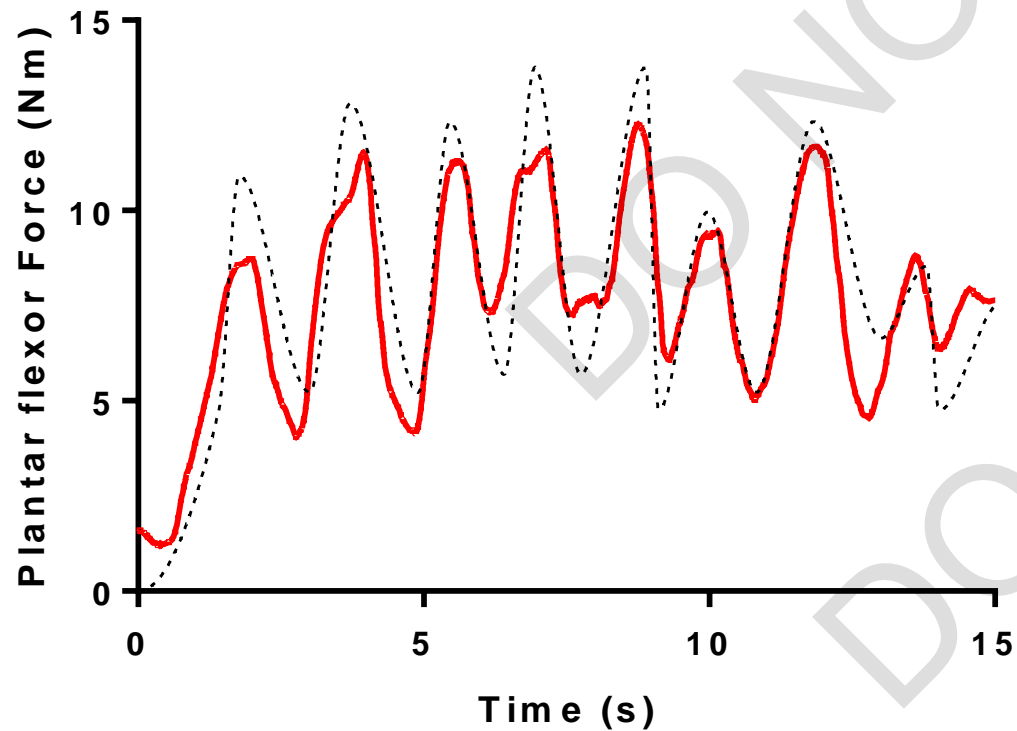
# Voluntary Activation



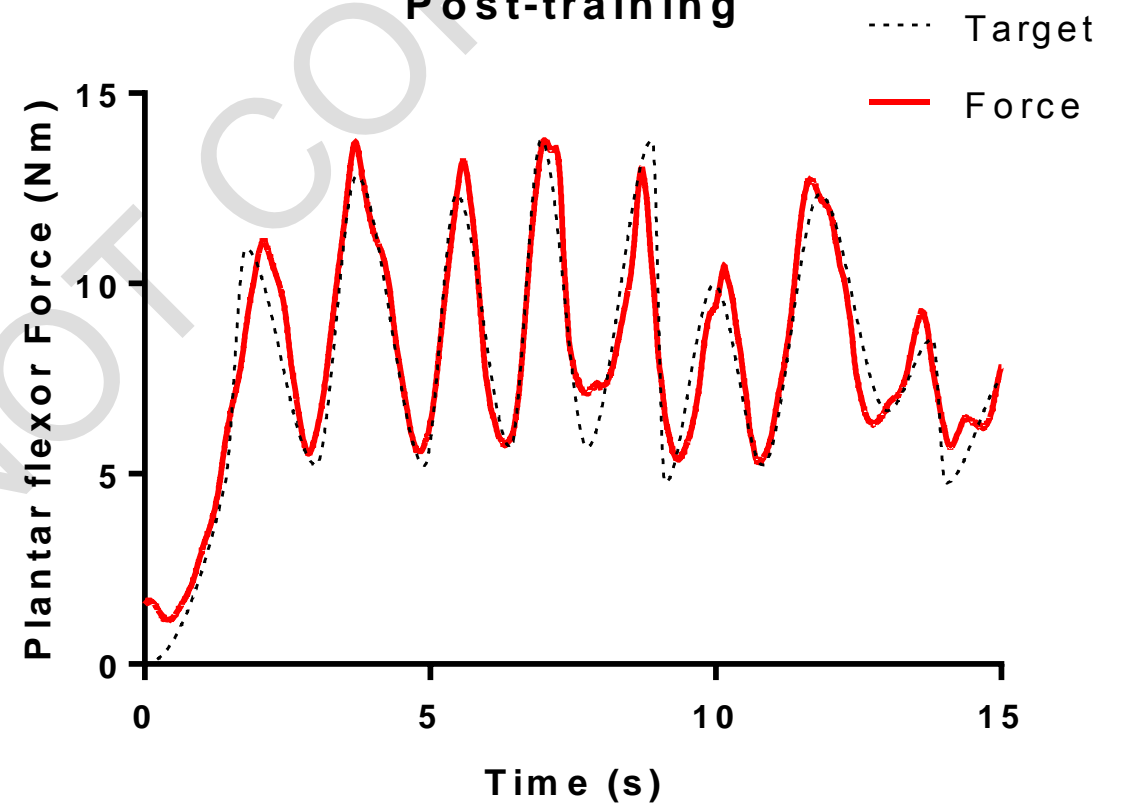


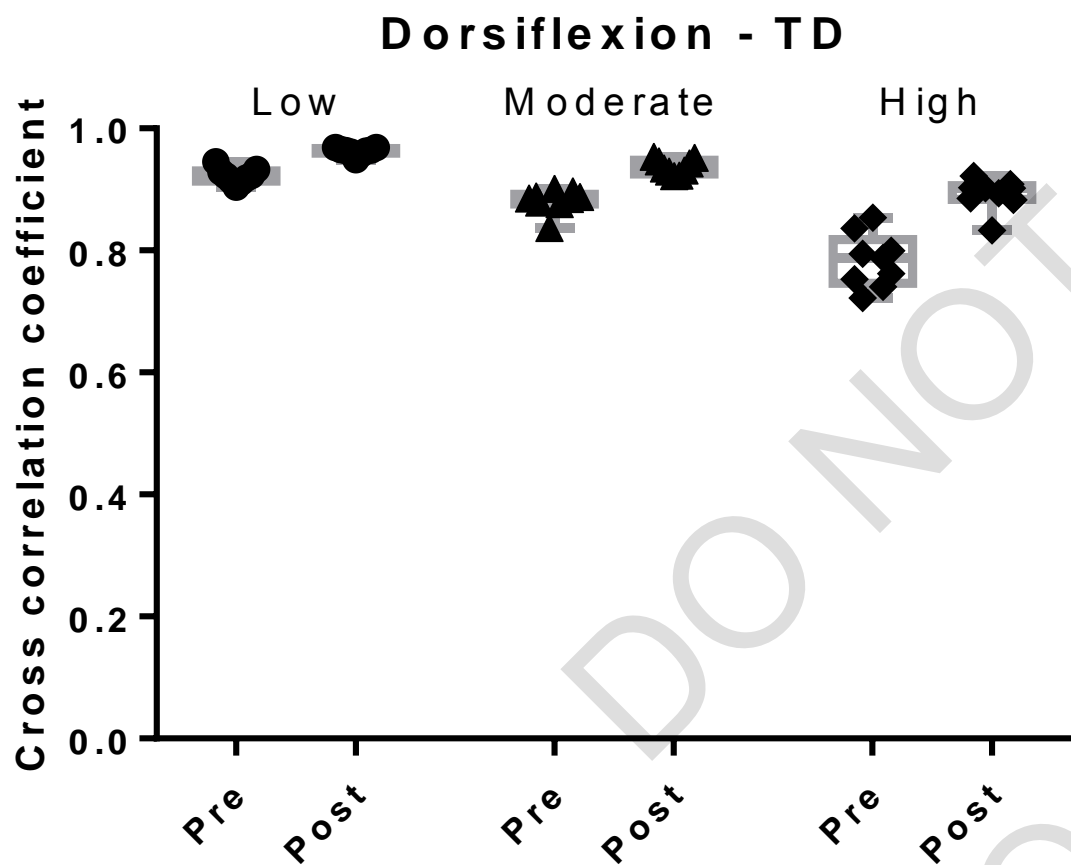
# Force Control

**Pre-training**



**Post-training**

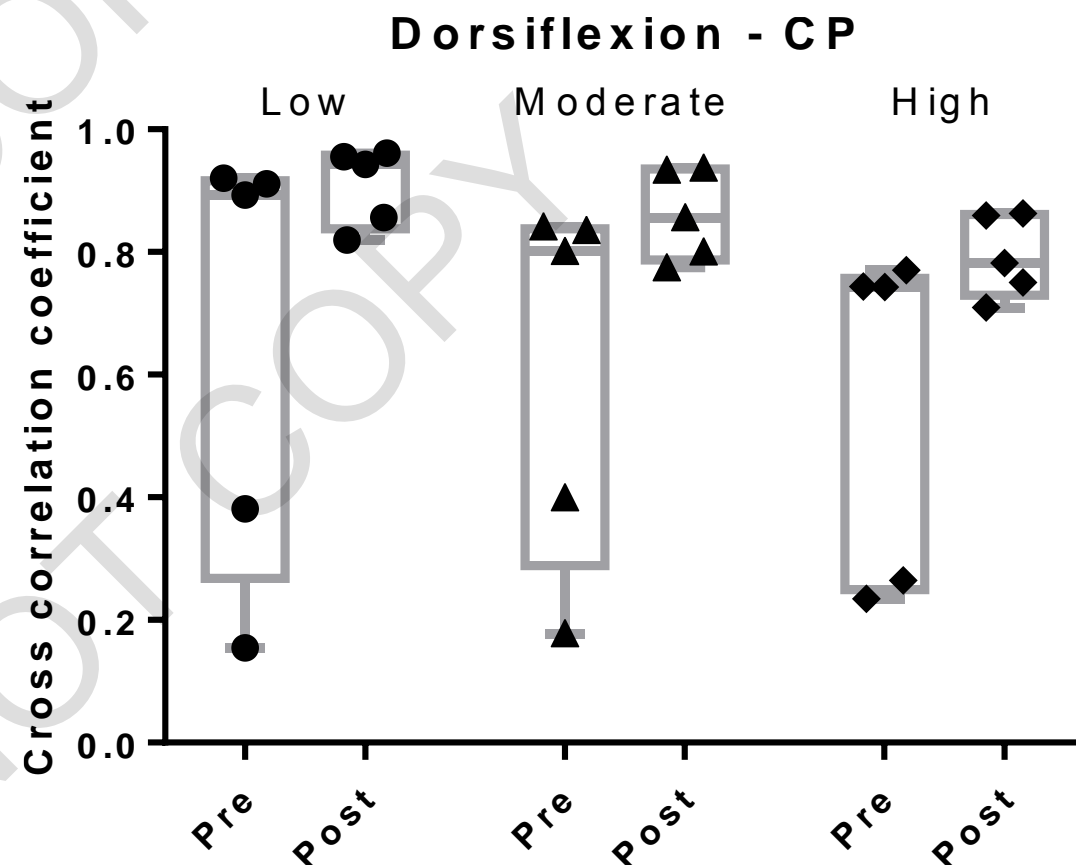




↑ 4.3%

↑ 6.3%

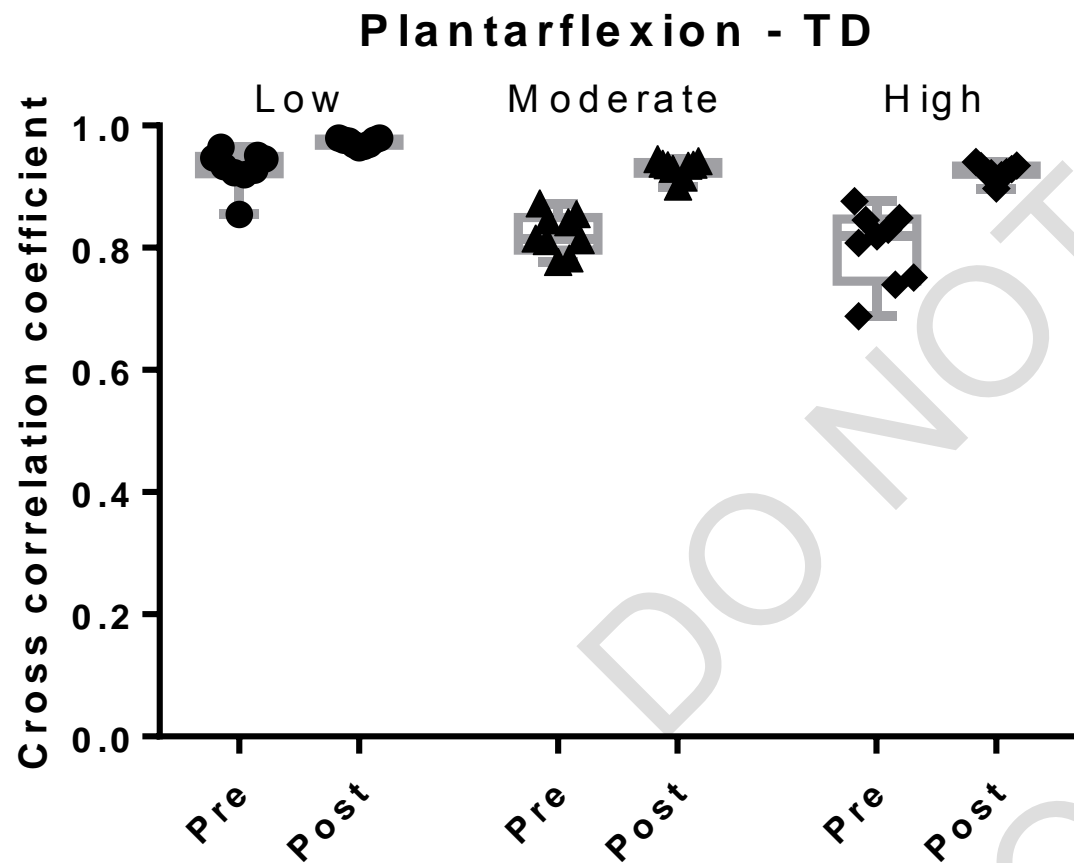
↑ 14.3%



↑ 116.6%

↑ 92.9%

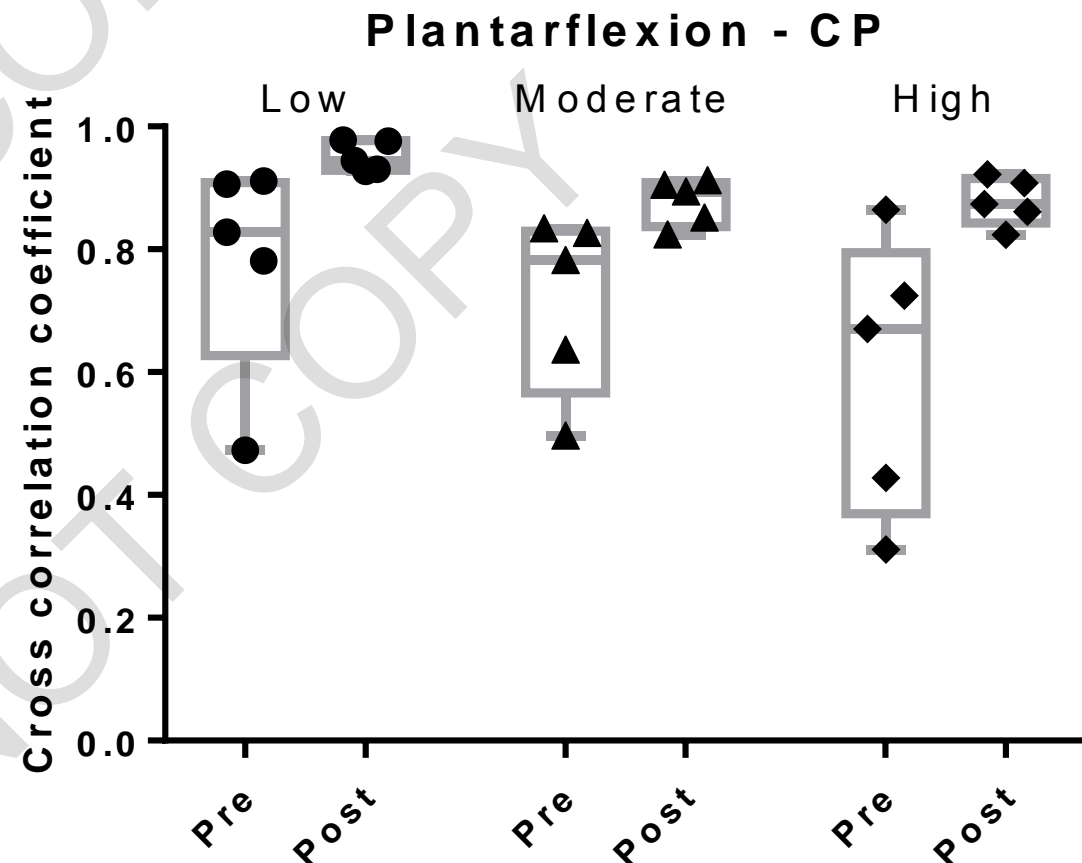
↑ 84.1%



↑ 4.8%

↑ 13.1%

↑ 16.1%



↑ 34.1 %

↑ 26.8%

↑ 66.7%

# Discussion



## Visuomotor training outcomes:

↔ Maximal muscle output  
↔ Voluntary activation capacity  
↑ **task performance**

Functional transfer?

**Motor learning potential**



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**Australian Government**

**National Health and Medical Research Council**

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