Comparing interlimb coupling between bilateral in-phase and anti-phase modes of a functional task and a non-functional movement in acute stroke

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Background

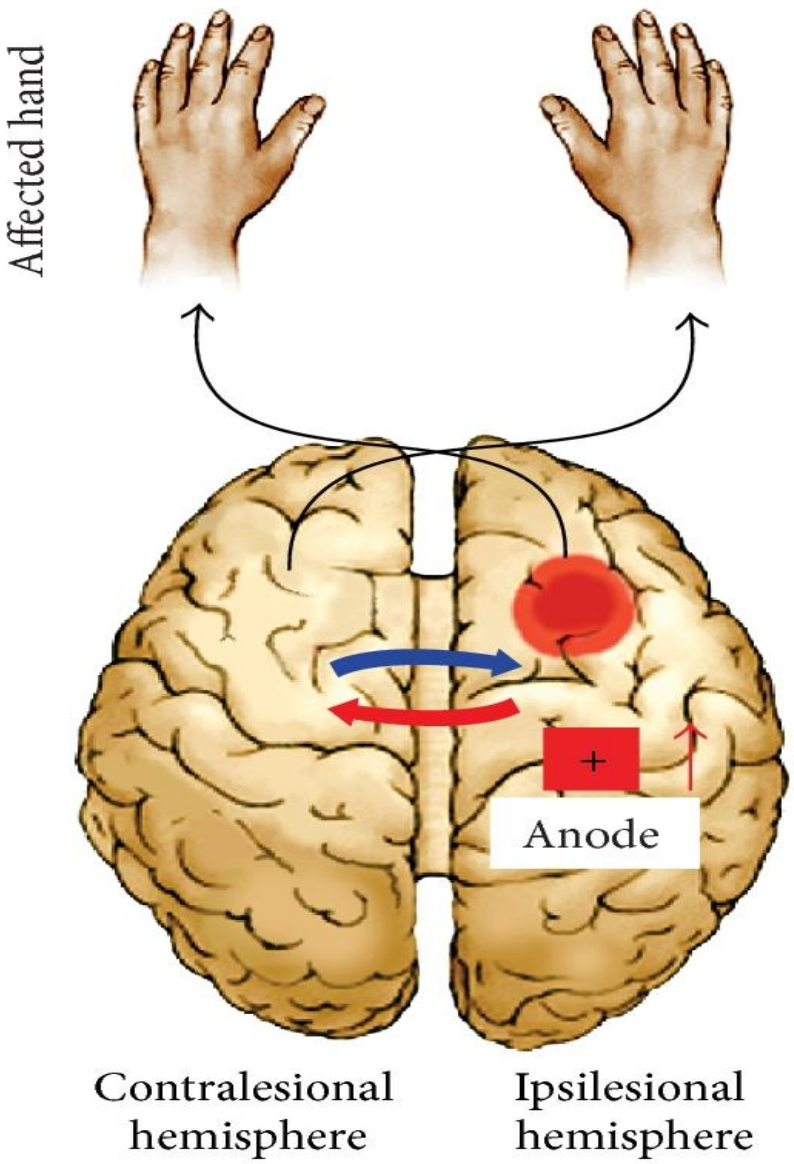
- **Bilateral upper limb training (BT):** practice of identical movements or tasks with both ULs
- **Individual studies:** ↑ velocity, ↑ smoothness of movement, long term functional recovery and changes in brain activation
- **Systematic reviews:** Inconclusive evidence to show significant benefits of BT over unilateral training, placebo or no training

Coupar et al 2010, Pollock et al. 2014

Interlimb Coupling

- Coupling effect where both hands adopt similar movement characteristics

- Theories: rebalance inter-hemispheric inhibition



Background

- Wide variation in delivery of BT (i.e. functional tasks and non-functional movements combined with IP and AP modes)

Choo et al 2015

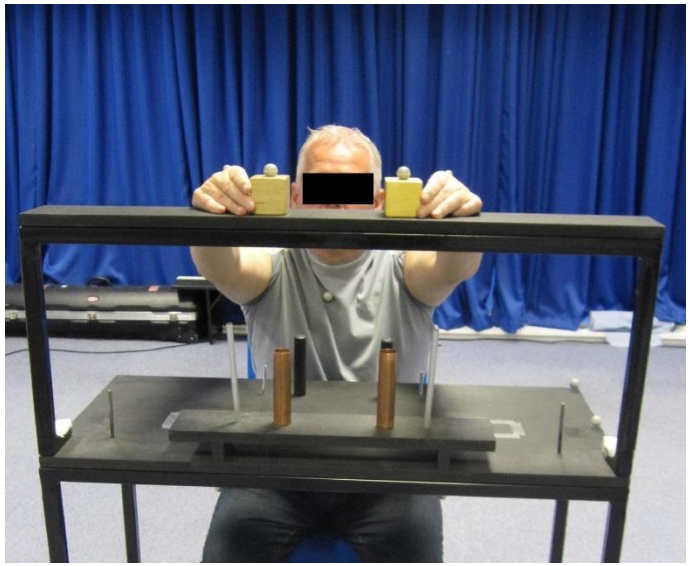
Bilateral in-phase (IP)

Bilateral anti-phase (AP)

Aim

To compare interlimb coupling between bilateral IP and bilateral AP modes of a functional discrete task and a non-functional cyclical movement in acute stroke individuals

Functional task

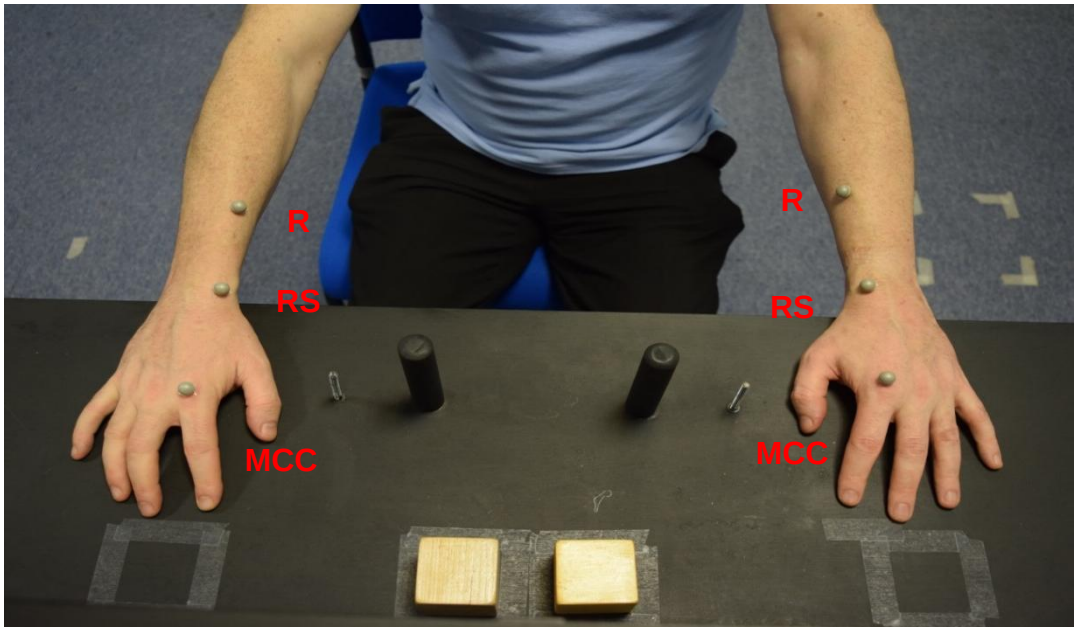


Non-functional movement

Methods

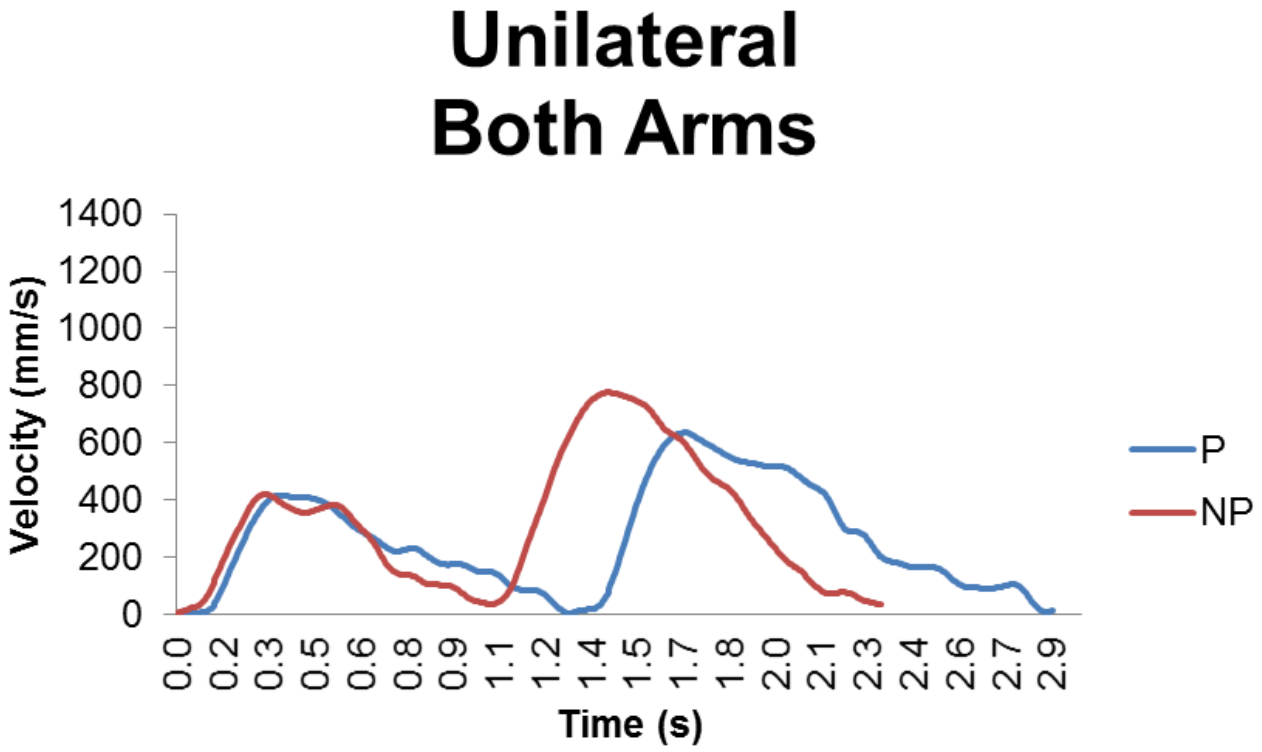
- A cross-sectional cohort study comprising 13 acute stroke individuals (mean age(SD) 62.4(12.4) years old; 5 males, 8 females).

- Motion capture: Each individual undertaking bilateral IP and bilateral AP modes of ARAT and continuous wrist flexion-extension movement



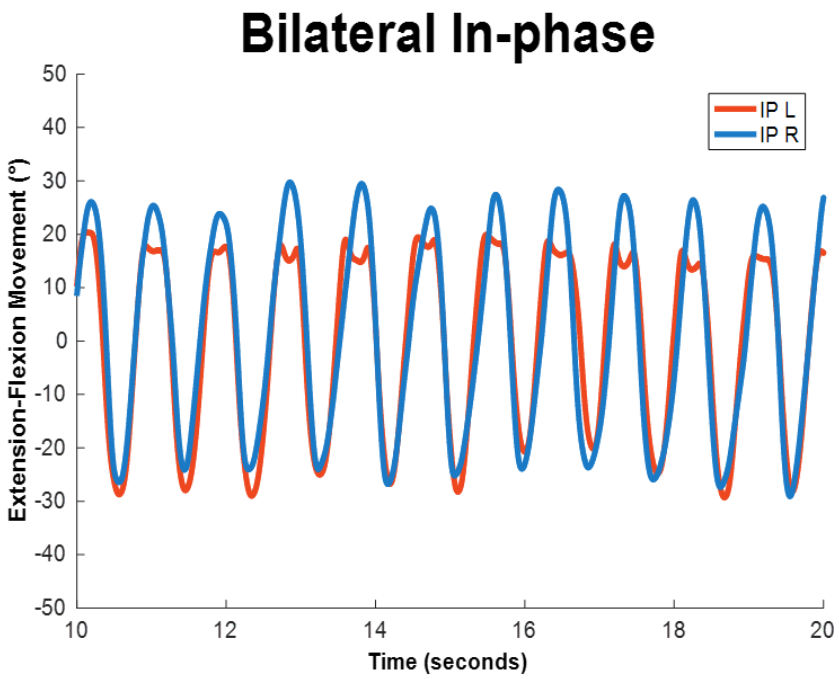
Methods

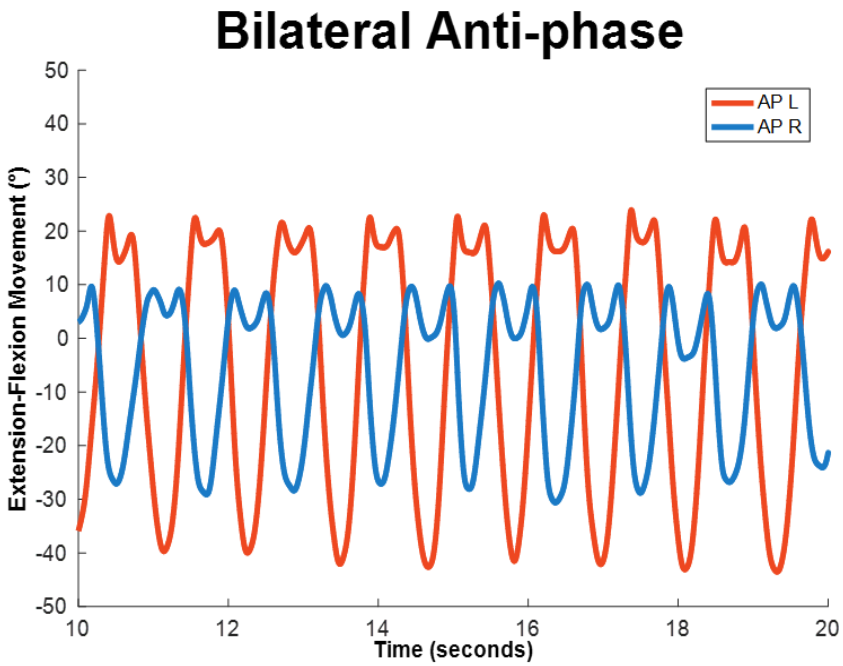
- Interlimb coupling of the ARAT grasp task was assessed through graphing velocity-time series.



Methods

- Interlimb coupling of continuous wrist flexion-extension was assessed through continuous relative phase, coordination stability and phase error.

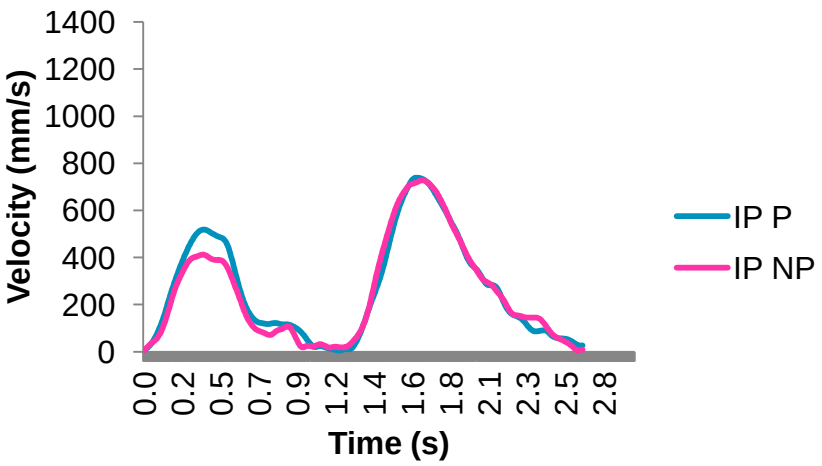




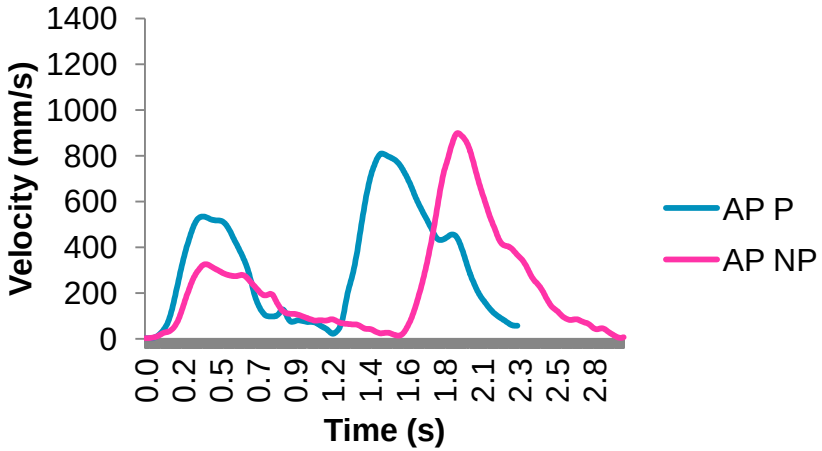
Results: ARAT Grasp Task

- During bilateral IP ARAT grasp task, both arms were coupled with similar velocity profiles and similar peak velocities throughout movement cycle.
- During bilateral AP ARAT grasp task, non-paretic arm was significantly slower with a higher peak velocity than paretic arm throughout movement cycle.

Bilateral In-phase

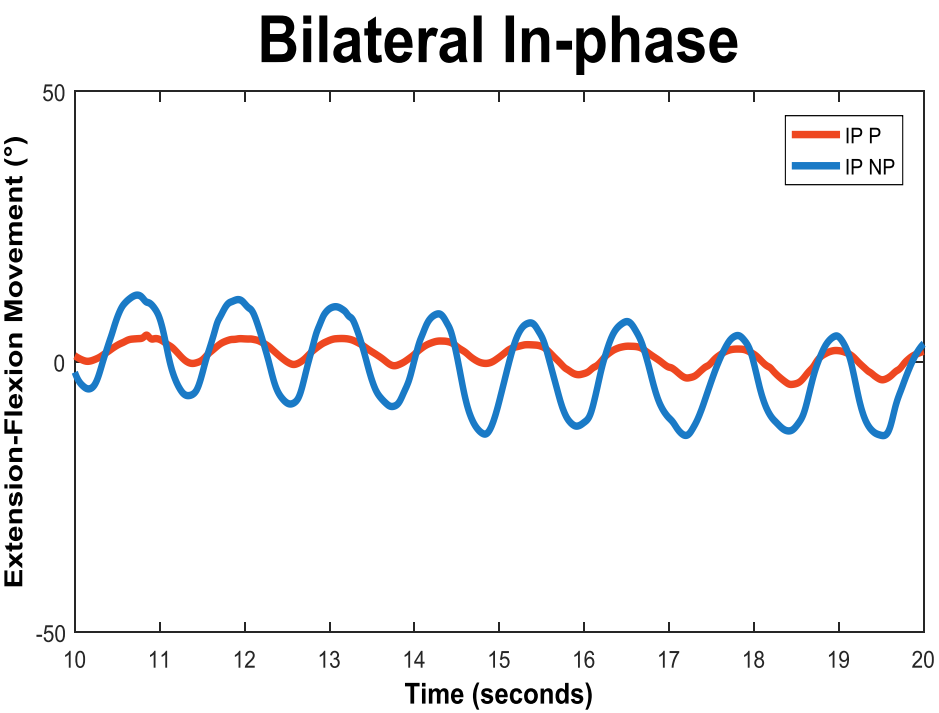


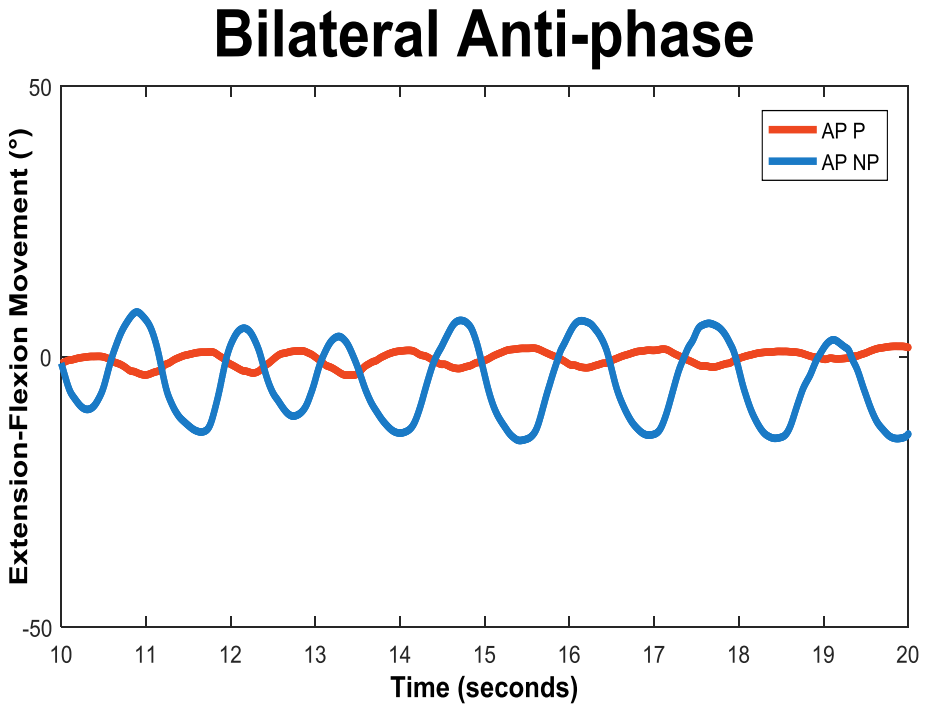
Bilateral Anti-phase



Results: Wrist Flexion-Extension

Relative phase: During bilateral IP and bilateral AP continuous wrist flexion-extension, strong interlimb coupling was maintained continuous relative phase of 1.9°and 178.9°respectively.





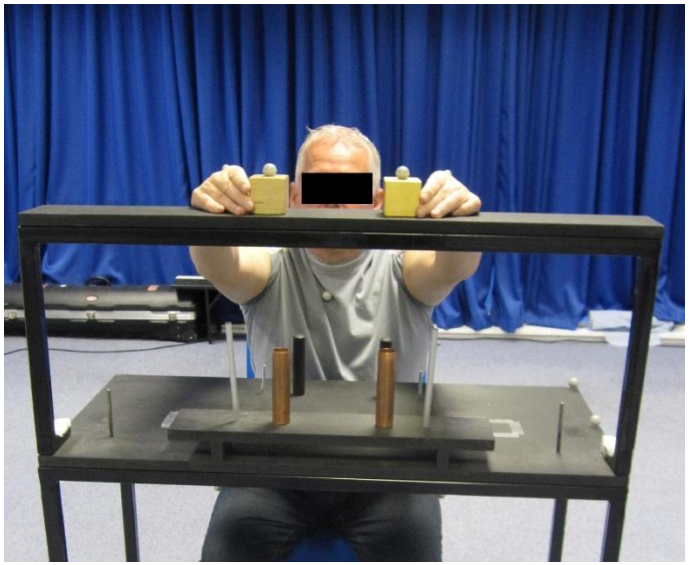
Results: Wrist Flexion-Extension

Coordination stability: Coordination stability was similar during bilateral IP (6.8°) and bilateral AP (16.4°) continuous wrist flexion-extension ($Z=-1.490$, $p=0.136$).

Coordination accuracy: Phase error was significantly smaller during bilateral IP than bilateral AP self-paced continuous wrist flexion-extension ($Z=-2.353$, $p=0.019$).

Discussion

- Interlimb coordination preserved regardless of movement modes



- Interlimb coordination dependent on movement mode (i.e. tight coupling during bilateral IP and decoupling during bilateral AP).

Interpretation

- Interlimb coupling is task-dependent; coordination in a non-functional movement should not be generalised to coordination in a functional, task during rehabilitation.
- Therapists should not mix both bilateral IP and bilateral AP modes of movement during BT practice.
- Exercise caution when using bilateral AP mode of functional tasks.

Thank You

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Choo, P. L., Gallagher, H. L., Morris, J., Pomeroy, V. M. and van Wijck, F. 2015. Correlations between arm motor behavior and brain function following bilateral arm training after stroke: a systematic review. Brain and Behavior, 5(12), pp. 1–25. doi: 10.1002/brb3.411.