



HAL
open science

Effects of an intensive rehabilitation program (Sirocco) on prefrontal activity during walking in patients with Parkinson Disease

Isabelle Hoang, Maud Ranchet, Maxime Cheminon, Romain Derollepot, Hannes Devos, Stéphane Perrey, Jacques Luaute, Laurence Paire-Ficout, Téodor Danaila

► To cite this version:

Isabelle Hoang, Maud Ranchet, Maxime Cheminon, Romain Derollepot, Hannes Devos, et al.. Effects of an intensive rehabilitation program (Sirocco) on prefrontal activity during walking in patients with Parkinson Disease. International Congress of Parkinson's Disease and Movement Disorders 2019, Sep 2019, NICE, France. hal-03027305v1

HAL Id: hal-03027305

<https://hal.science/hal-03027305v1>

Submitted on 27 Nov 2020 (v1), last revised 23 Mar 2021 (v2)

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Effects of an intensive rehabilitation program (Sirocco) on prefrontal activity during walking in patients with Parkinson Disease

Isabelle Hoang¹, Maud Ranchet¹, Maxime Cheminon⁴, Romain Derollepot¹, Hannes Devos³, Stéphane Perrey², Jacques Luauté^{4,5,6}, Laurence Paire-Ficout¹, Teodor Danaila⁷

¹ Université de Lyon, F-69000 Lyon, France-IFSTAR, TS2, LESCOT, F-69500 Bron

² EuroMov, Univ. Montpellier, Montpellier, France.

³ Department of Physical Therapy and Rehabilitation Science, School of Health Professions, The University of Kansas Medical Center, Kansas City, KS, USA

⁴ Service de rééducation neurologique, Hôpital Henry-Gabrielle, Hospices Civils de Lyon, Lyon, France.

⁵ Inserm UMR-S 1028, CNRS UMR 529 ; ImpAct, Centre de Recherche en Neurosciences de Lyon, université Lyon-1, 16, avenue Lépine, 69676 Bron, France.

⁶ Université de Lyon, Université Claude Bernard Lyon 1, Lyon, France.

⁷ Centre de Neurosciences Cognitives, Service de Neurologie C, Hôpital Neurologique Pierre Wertheimer, Hospices Civils de Lyon, Université Claude Bernard Lyon I, Lyon.

Background + objective

- **Physical exercises have beneficial effects** on cognition¹ and can induce neuroplasticity by enhancing the compensatory scaffolding mechanism²
- In Lyon (France), an **intensive collective multidisciplinary rehabilitation program (Sirocco)** was developed for patients with PD, focusing on intensive, high amplitude movements and loudness in the speech
- Dual-task walking is generally used to assess executive functions³, localized in the dorsolateral prefrontal cortex (DLPFC)
- The objective of the present study is to investigate the effects of a 5-week intensive rehabilitation program (Sirocco) on DLPFC activity and on walking performance in PD patients

Hypothesis

Changes in DLPFC activation and improvement of walking performance are expected after the Sirocco program



Figure 1: Walking path

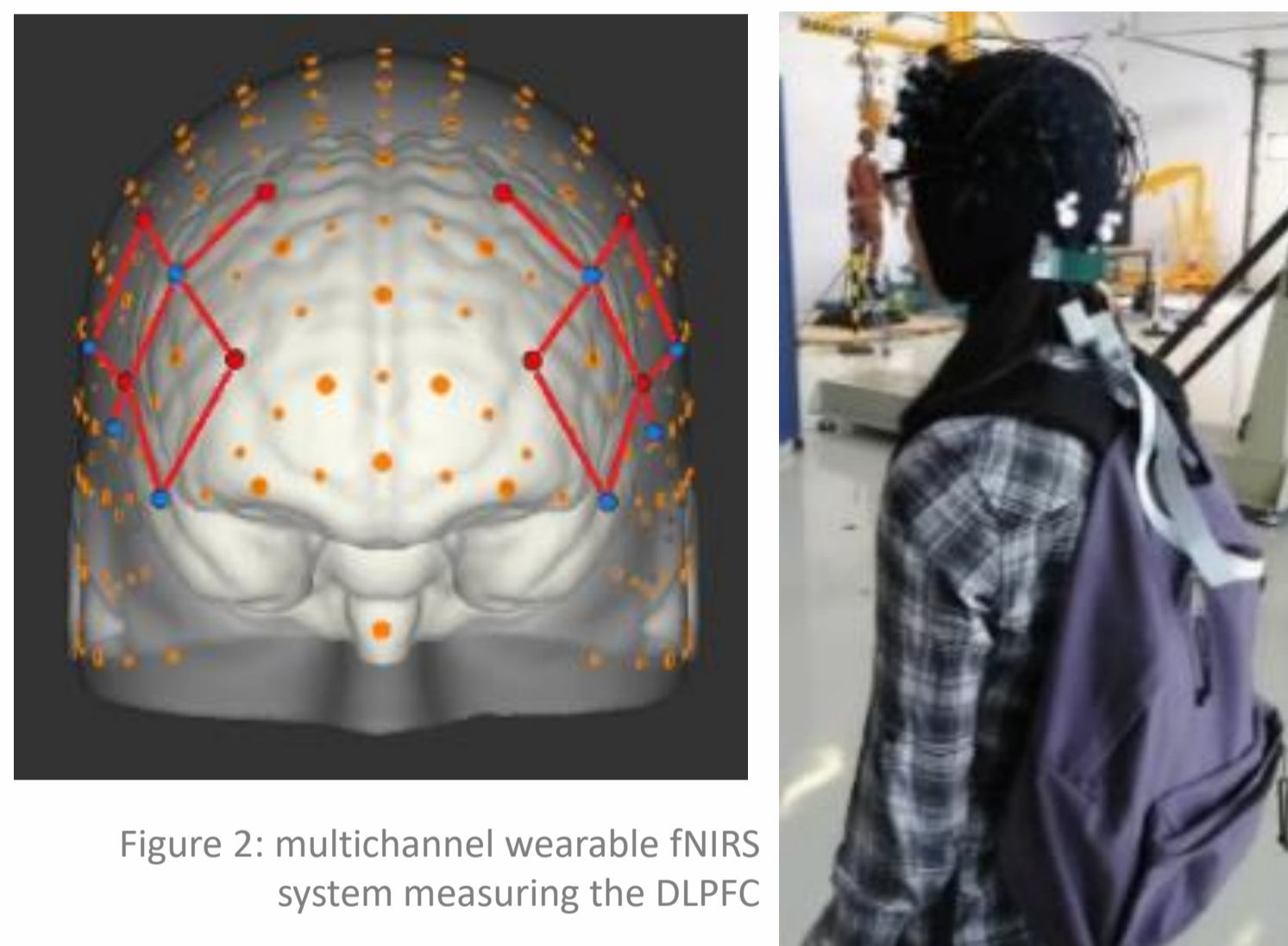


Figure 2: multichannel wearable fNIRS system measuring the DLPFC

Methods

Participants: 9 patients with PD (65 years old \pm 6.4 ; 7 M / 2 F)

Task (random order) (Fig.1):

- Usual Walking
- Subtracting
- Walking while subtracting

Measurements: changes in oxygenated hemoglobin (Δ HbO₂) in the DLPFC using *functional Near Infra-Red Spectroscopy (fNIRS)* (Fig.2) + gait speed (m/s)

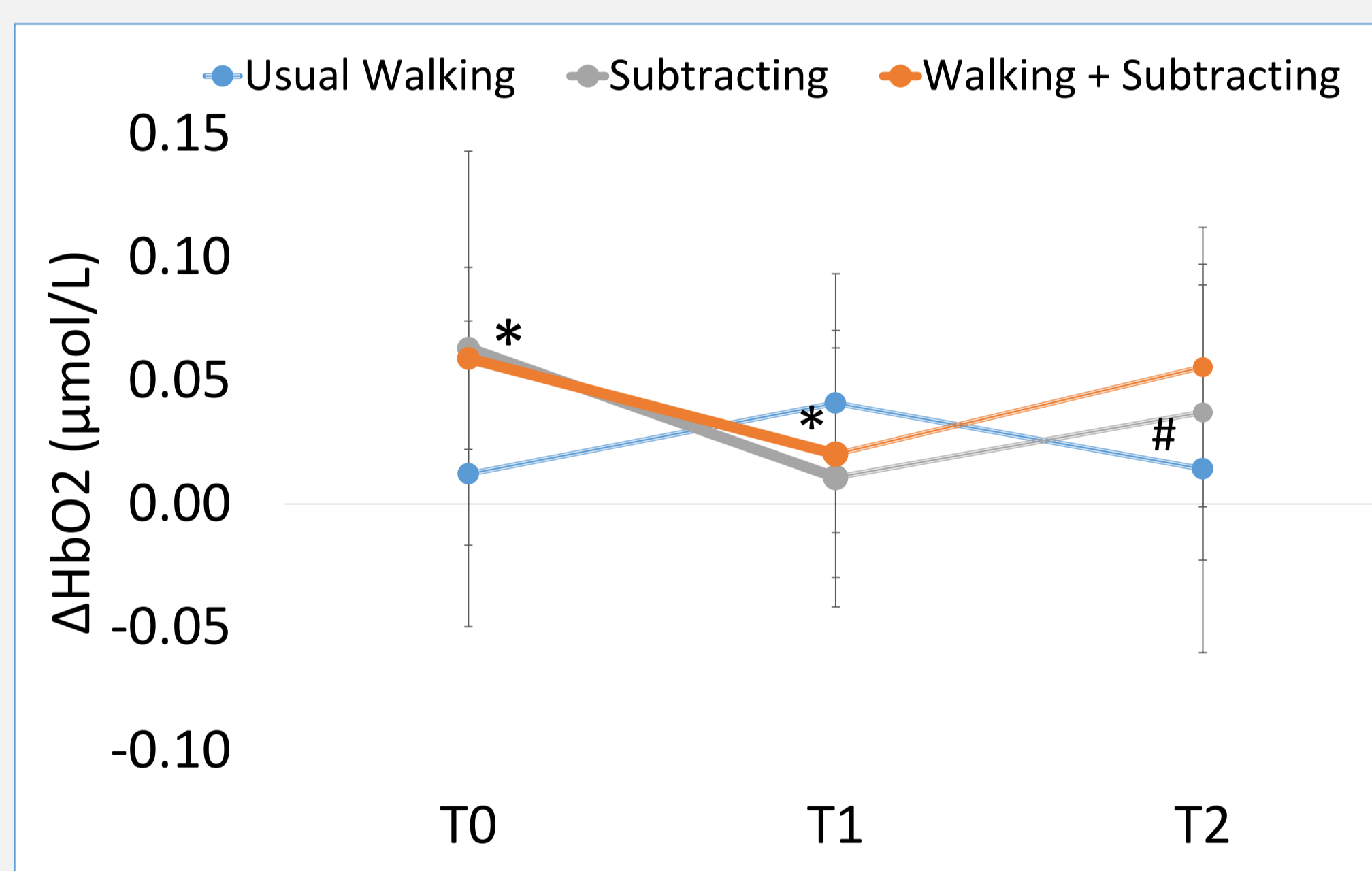
Assessments

3 times:

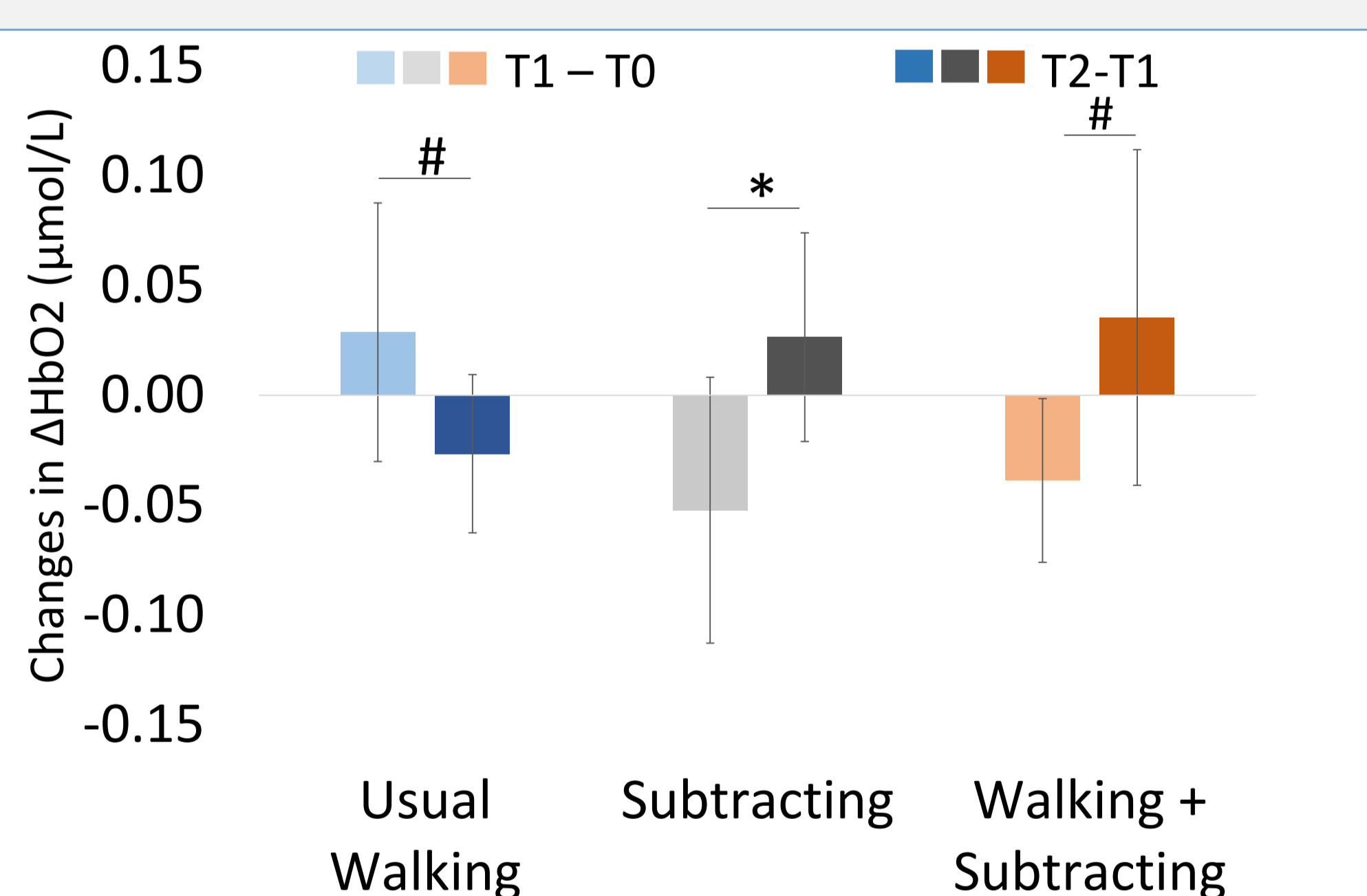
- Five weeks **before** the program (**T0**)
- Few days **before** (**T1**)
- One week **after** the program (**T2**)

Results

DLPFC activity



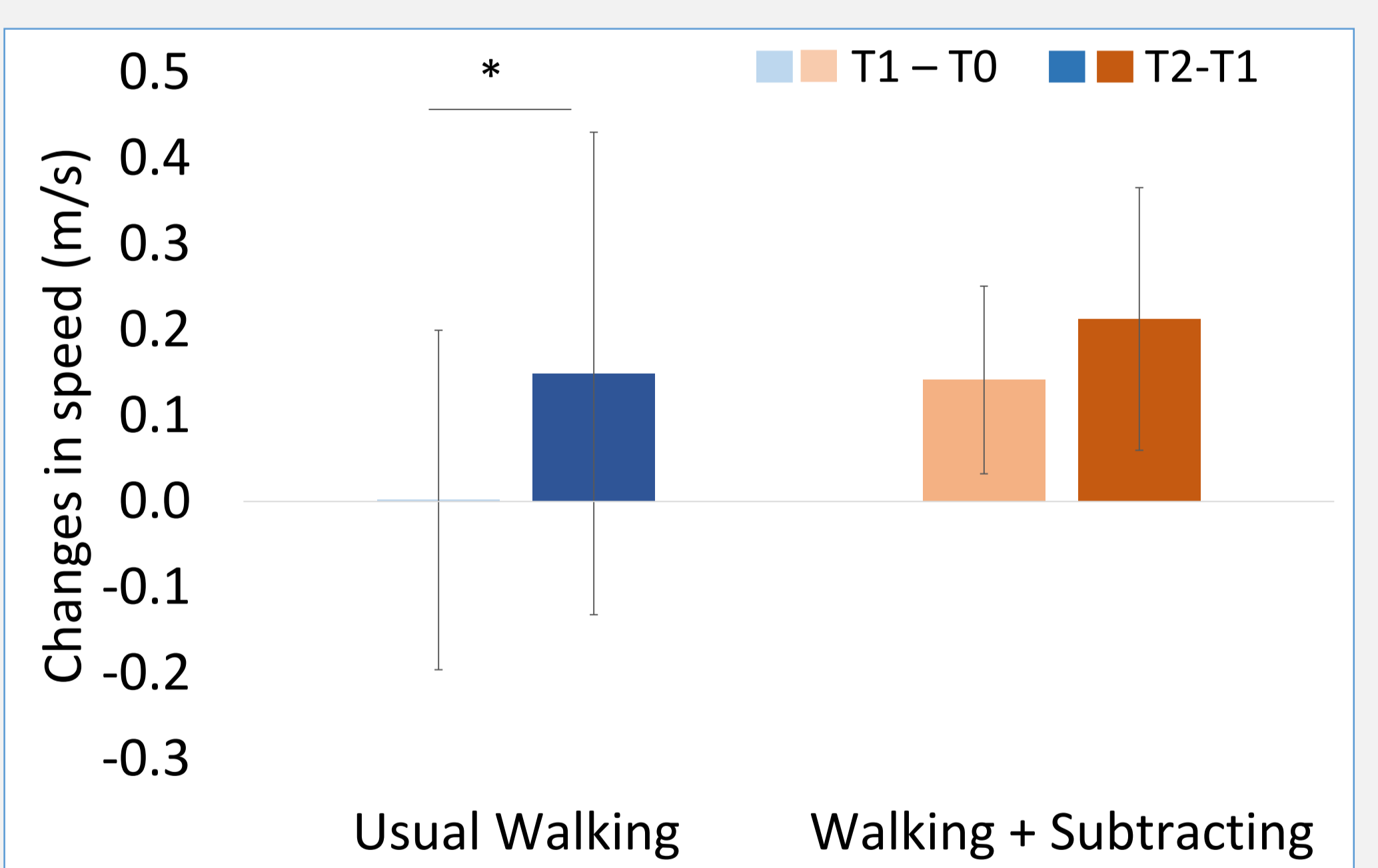
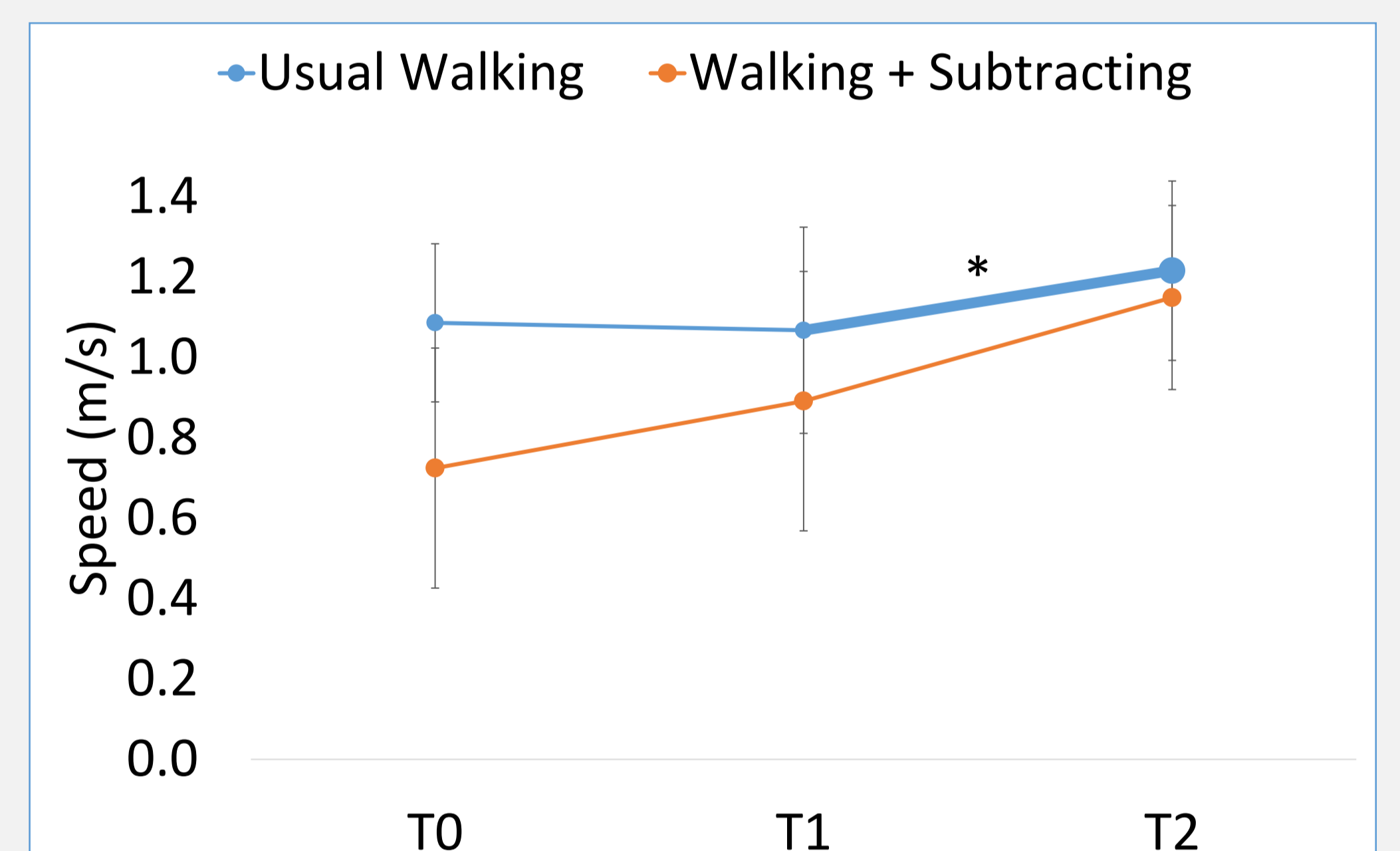
Means (\pm SD) at each assessments



Comparison between T1-T0 and T2-T1

* p<0.05
0.05<p<0.10

Walking performance



Conclusion

- Prefrontal activity during usual walking and during dual-task walking is modified after the rehabilitation program: it decreased in walking and increased in walking while subtracting
- These changes may be accompanied with increased gait speed, especially during usual walking
- These preliminary results suggest that patients require less cognitive resources in usual walking and that they are able to solicit more cognitive resources to improve their performance in a complex walking situation (dual-task)
- Larger sample size is needed to confirm the beneficial effects of the rehabilitation program
- These results will have important implications for clinical practice and rehabilitation

References

1. Joubert, C., & Chainay, H. (2018). Aging brain : The effect of combined cognitive and physical training on cognition as compared to cognitive and physical training alone – a systematic review. *Clinical Interventions in Aging*, 13, 1267-1301. <https://doi.org/10.2147/CIA.S165399>
2. Reuter-Lorenz, P. A., & Park, D. C. (2014). How does it STAC up? Revisiting the scaffolding theory of aging and cognition. *Neuropsychology Review*, 24(3), 355-370. <https://doi.org/10.1007/s11065-014-9270-9>
3. Mirelman, A., Shema, S., Maidan, I., & Hausdorff, J. M. (2018). Gait. In *Handbook of Clinical Neurology* (Vol. 159, p. 119-134). <https://doi.org/10.1016/B978-0-444-63916-5.00007-0>

✉ Isabelle.hoang@ifstar.fr