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

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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

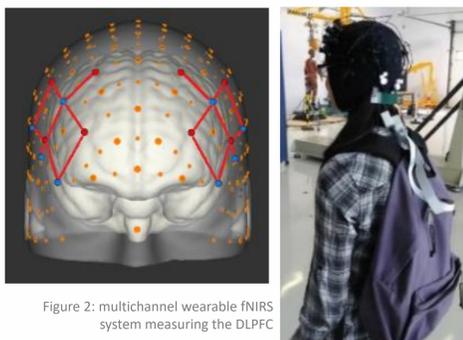


Figure 2: multichannel wearable fNIRS system measuring the DLPFC

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

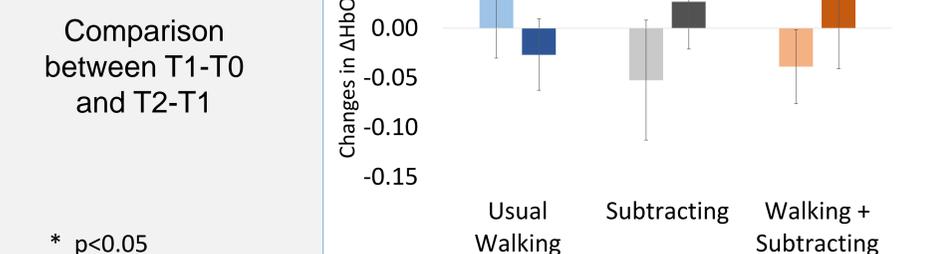
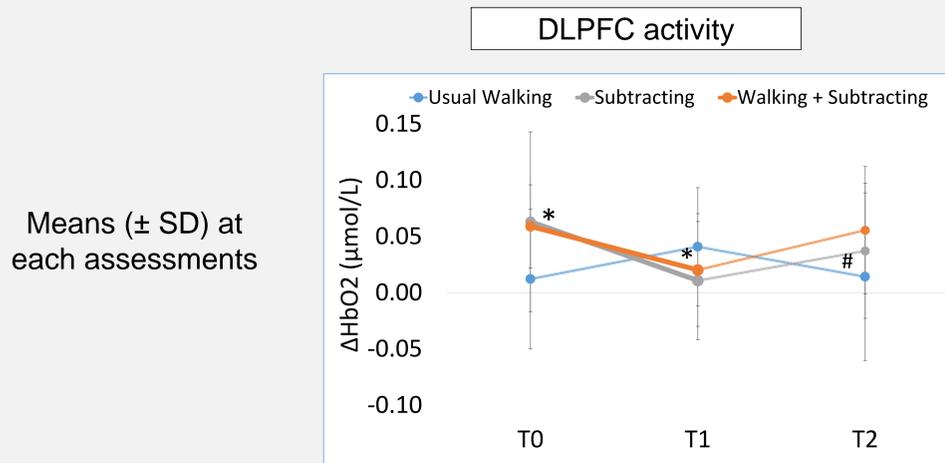
Measurements: changes in oxygenated hemoglobin (Δ HbO₂) in the DLPFC using *functional Near Infra-Red Spectroscopy (fNIRS)* (Fig.2) + gait speed (m/s)

Assessments

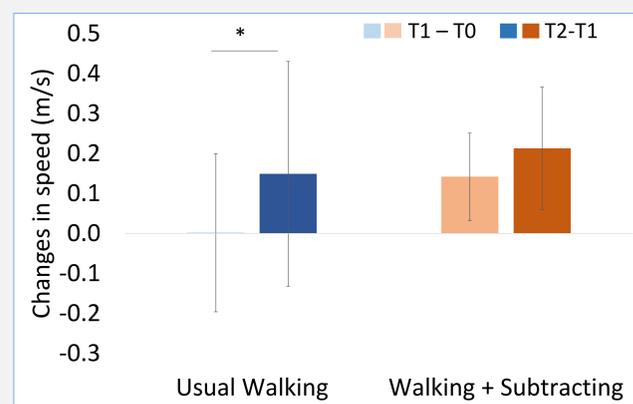
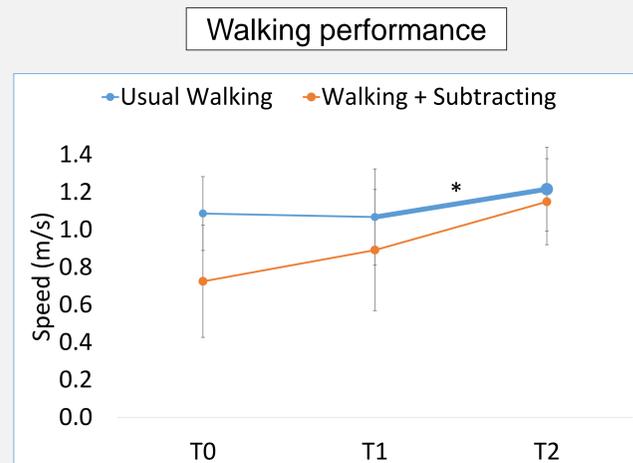
3 times:

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

Results



* p<0.05
0.05<p<0.10



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>

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