



Cognitive and Functional Connectivity changes following Network-based Cognitive Tele-rehabilitation in amnesic MCI

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Introduction

Tele-rehabilitation (TR) represents a promising approach for delivering rehabilitative services to a broader population; however, several challenges remain in its implementation for older adults with early cognitive deficits.

Objective

The main goal of this study was to assess the feasibility and efficacy of a Network-Based Cognitive Rehabilitation Treatment (NBCT), already validated on a face-to-face mode (De Marco et al 2016) implemented into a Tele-rehabilitation platform. Specifically, the study investigated its effects on global cognitive functioning and brain functional connectivity in patients with amnesic Mild Cognitive Impairment (MCI).

Methods

Participants:

- Six patients with amnesic MCI (three females; mean age 74.5 ± 6.1 years; education 10.8 ± 3.2 years; mean MMSE 27.5 ± 0.5) were recruited at the Cognitive Disorders and Dementia Centre (CDCD) of Parma.
- All patients underwent:
 - MR acquisition: 3 T GE scanner (Resting-state sequence) at T0 and T1
 - Extensive neuropsychological evaluation at T0 and T1
 - NBCT

NBCT: 20 consecutive sessions of NBCT delivered via a tele-rehabilitation platform, administered five times per week over four weeks.

All participants completed a comprehensive neuropsychological assessment and a resting-state fMRI scan before (T0) and after treatment (T1).



Figure 1. NBCT example

- Statistical analyses were conducted using paired t-tests on cognitive data and on maps of functional connectivity (FC) of the Default Mode Network (DMN).
- Percentage improvement in neuropsychological scores was computed as $[(\text{post-pre})/\text{pre}] \times 100$, with sign inversion for measures where lower scores indicate better performance.

Results

- Consistent improvements across all patients were observed, with greater gains in Trail Making Test – Part B (55.9%) and Rey Complex Figure – delayed recall (20.0%), and smaller gains in Rey 15-word immediate recall (8.0%) and Raven's Progressive Matrices (6.9%). (Figure 2)

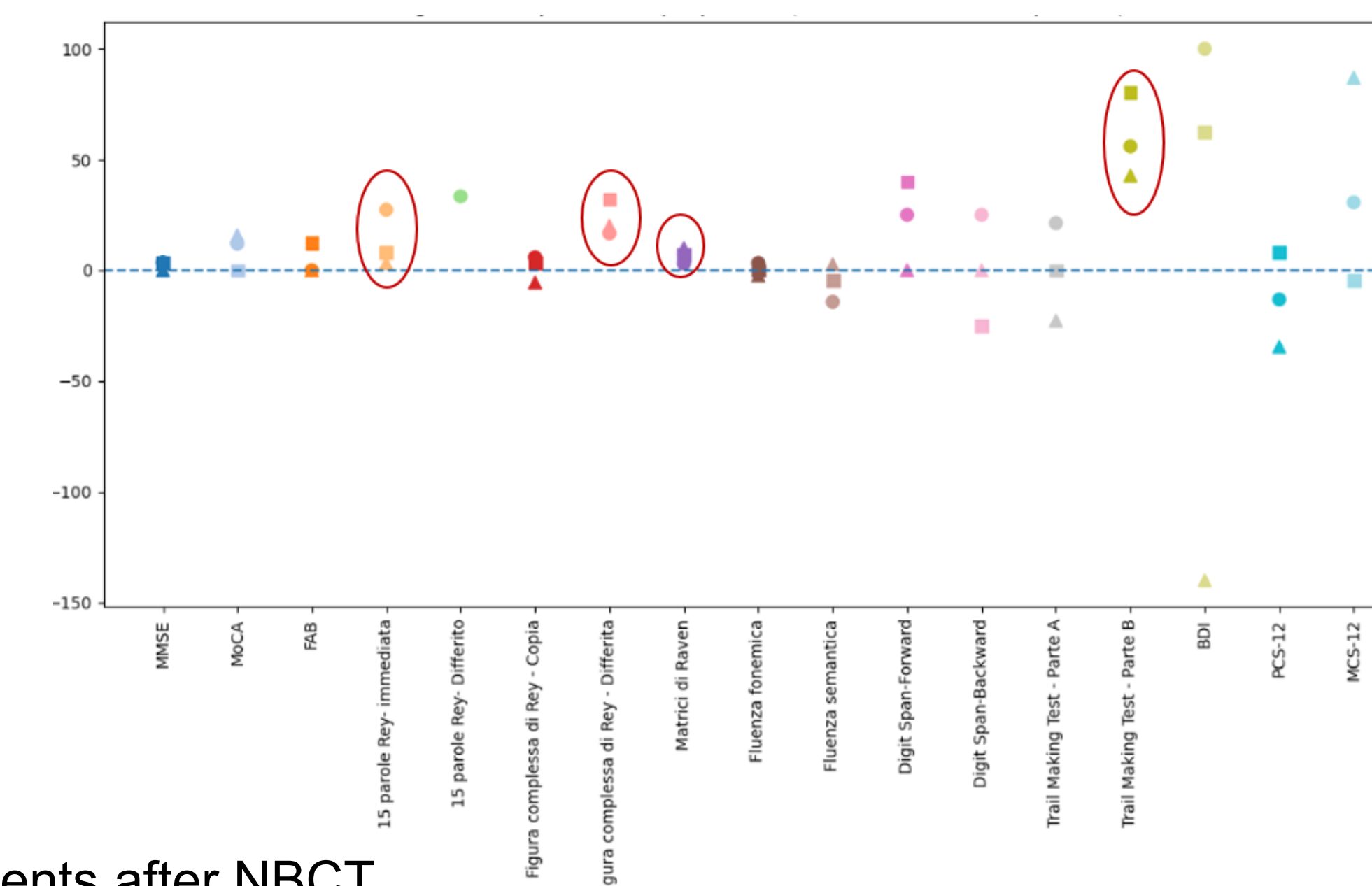


Figure 2: Cognitive improvements after NBCT

- Analyses of fMRI data revealed group-level increases in DMN-FC in temporal, cerebellar and subcortical areas (i.e. caudate), while decreases were observed in frontal and subcortical areas (i.e. pulvinar) (Figure 3 e Figure 4).

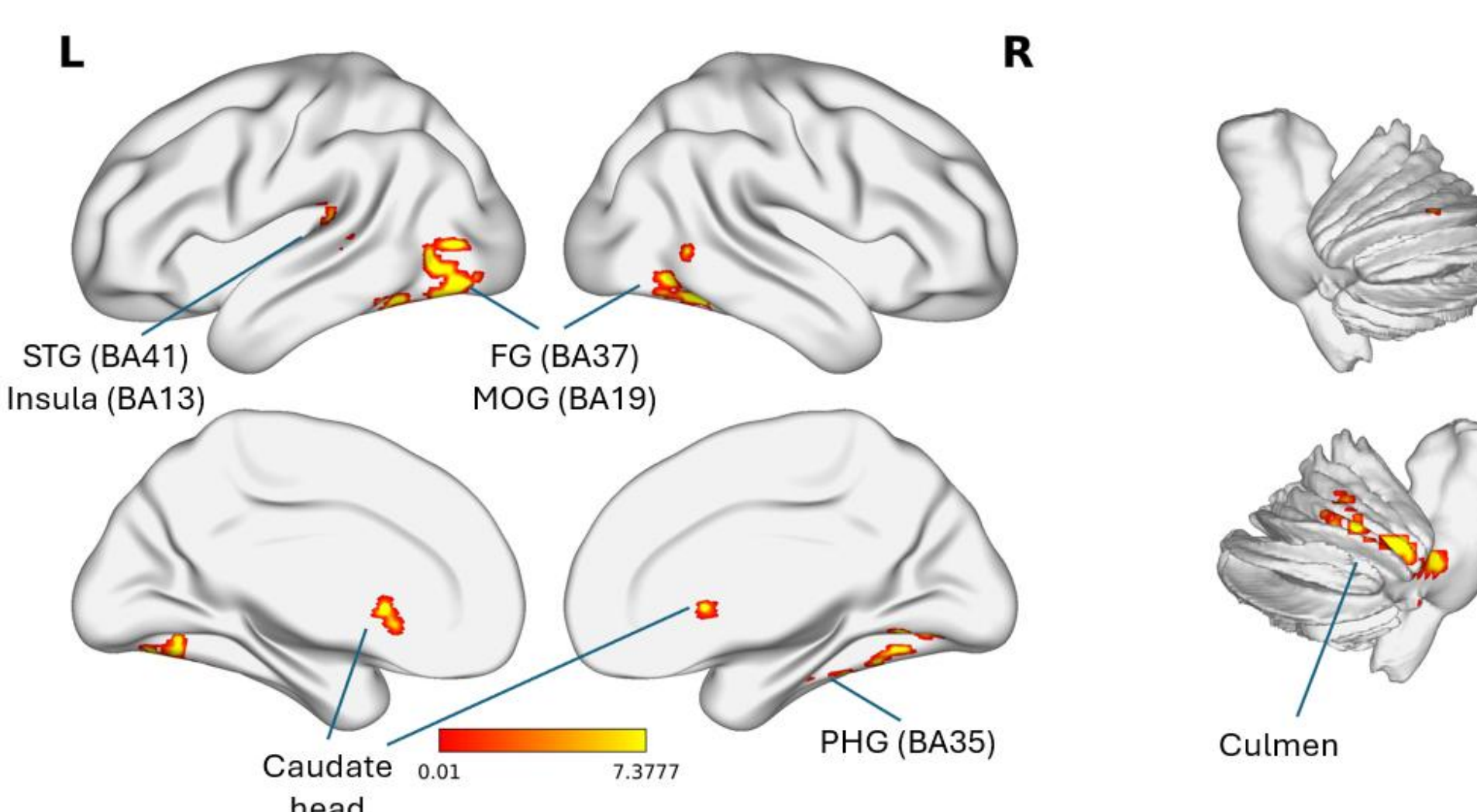


Figure 3: Increase in DMN functional connectivity

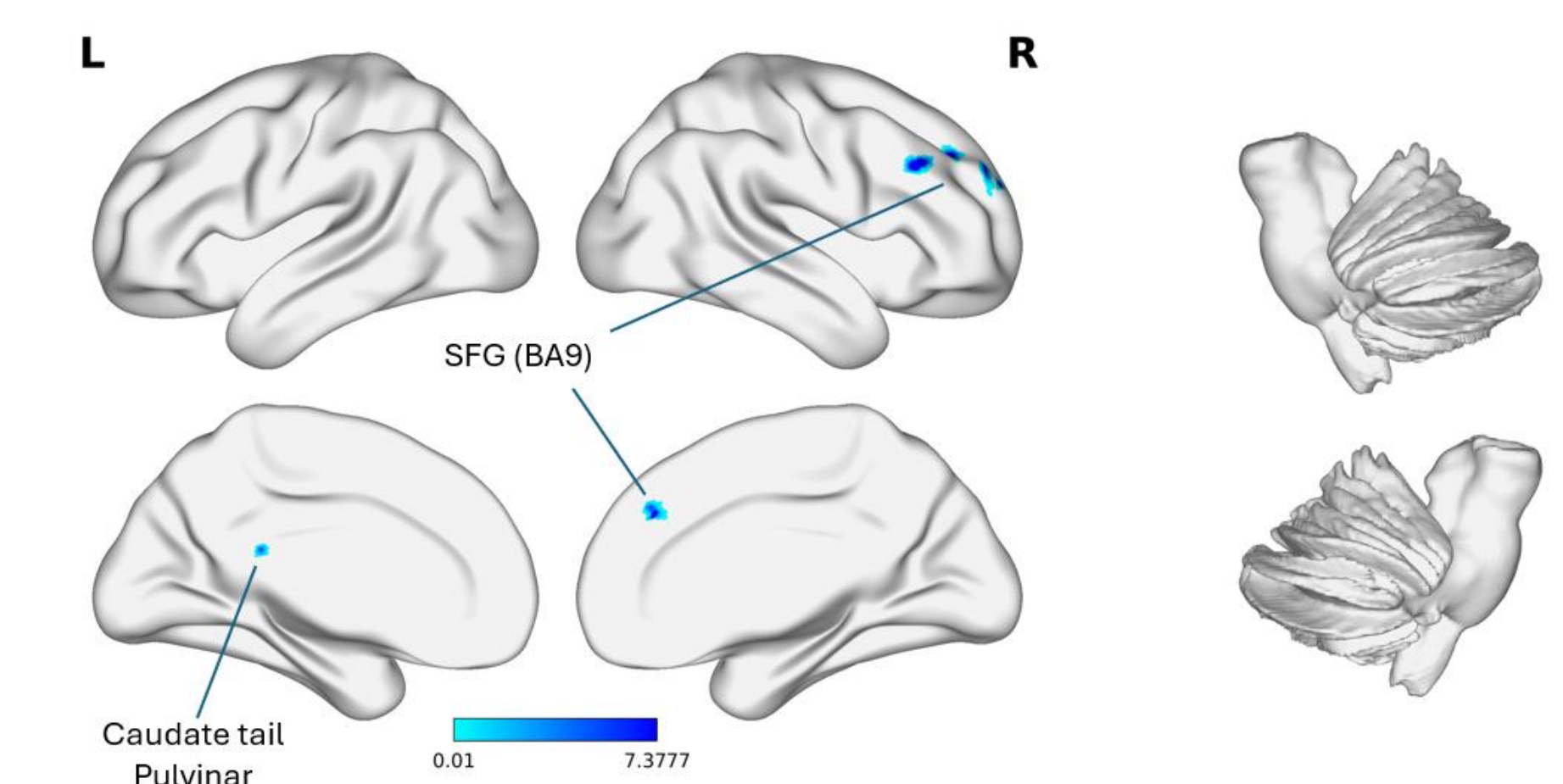


Figure 4: Decrease in DMN functional connectivity

Conclusions

- In conclusion, these preliminary findings support the feasibility and potential efficacy of a network-based cognitive intervention delivered through a tele-rehabilitation platform. However, further studies with larger sample sizes and longer follow-up periods are needed to confirm these results.

REFERENCES

De Marco M, Meneghello F, Duzzi D, Rigon J, Pilosio C, Venneri A. Cognitive stimulation of the default-mode network modulates functional connectivity in healthy aging. *Brain Res Bull.* 2016 Mar; 121:26-41. doi: 10.1016/j.brainresbull.2015.12.001.