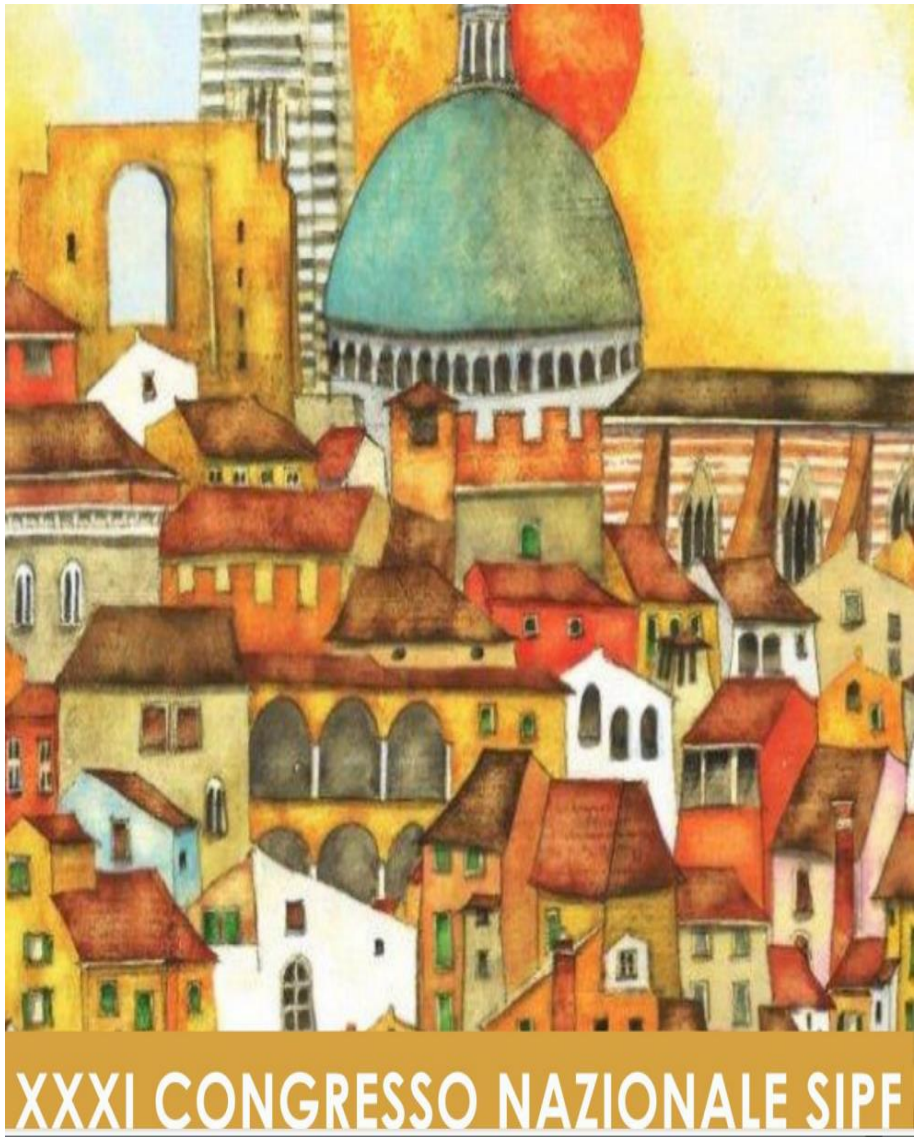
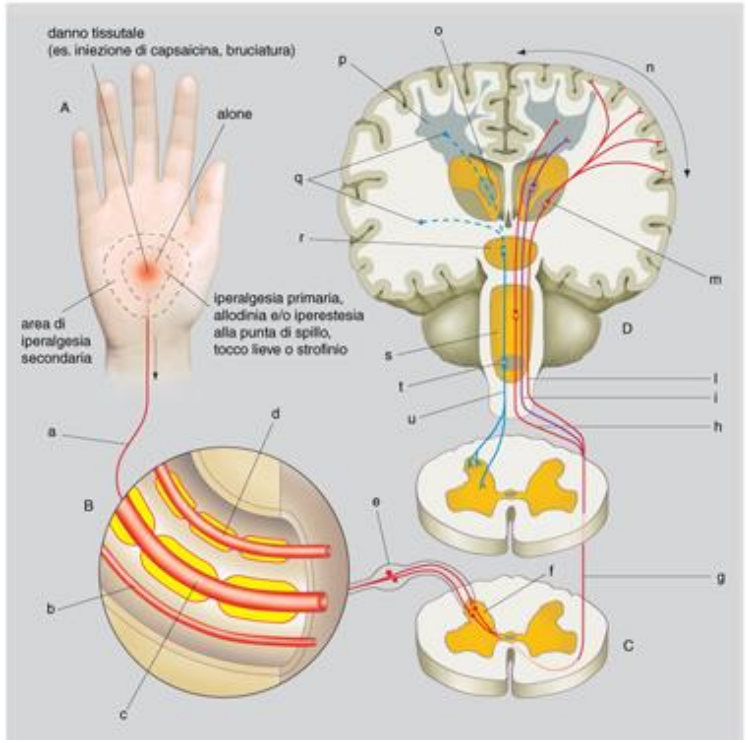


Metabolic changes of motor cortex induced by movement execution and observation in chronic pain and extrapyramidal disorders

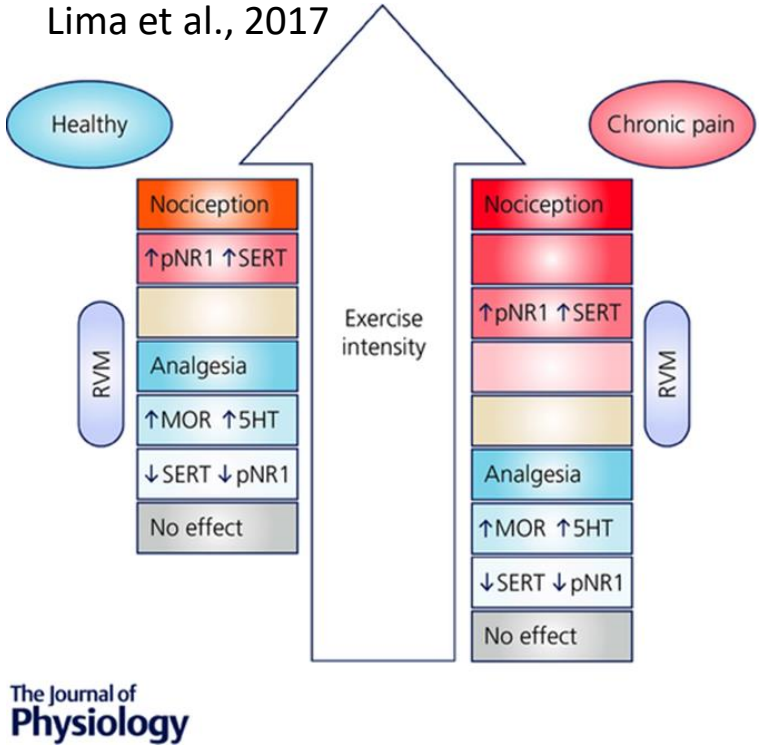
Marina de Tommaso (Bari)

Fibromyalgia

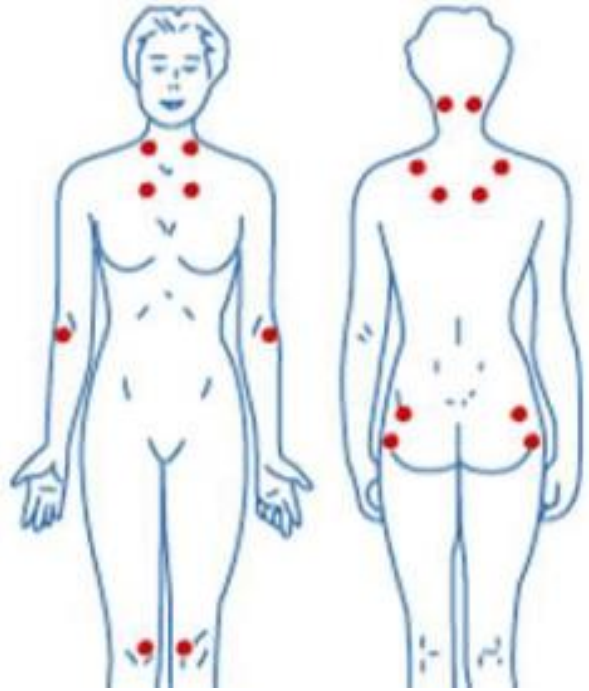
Pain reduces motor activity, inhibiting motor cortex in a self-sustained mechanism of chronic symptoms maintenance.



Lima et al., 2017



The Journal of Physiology

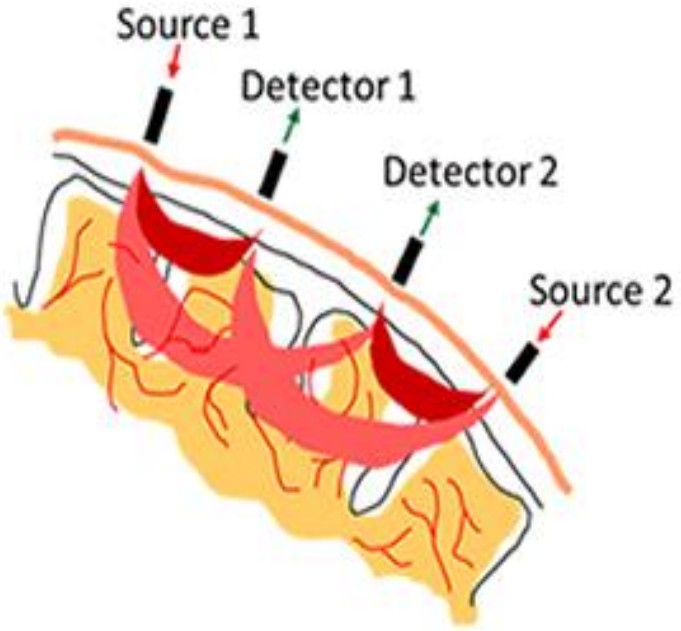


How does the NIRS work?

- The sources emit NIR photons that penetrate into the biological tissue and then they are absorbed by detectors. The NIR photons follow a banana-shape path. Along the path the NIR photons undergo two processes: scattering and absorption.

- The skin, skull and tissues are trasparent to NIR wavelenghts, while O2Hb and HHb absorb these spectra.

- Absorption of NIR photon is mainly due to hemoglobin. When there is a brain activation we can see the changes in hemoglobin concentration.



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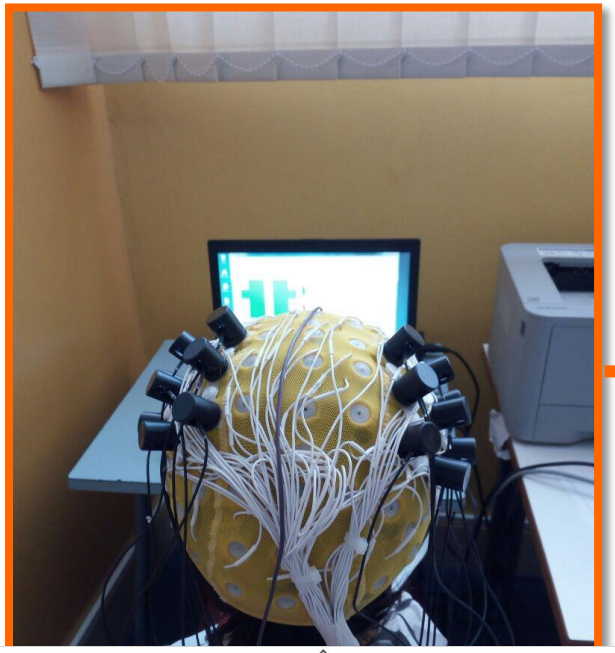


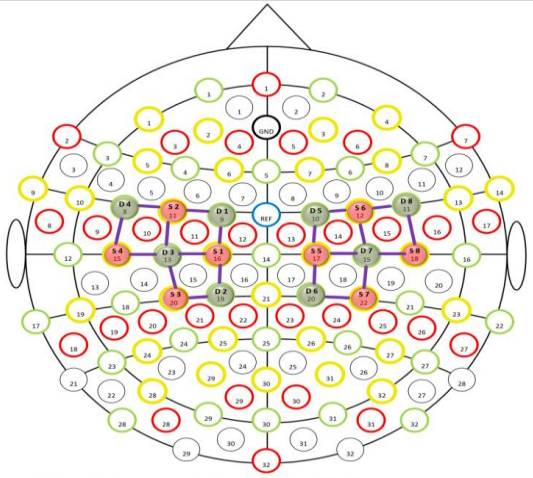


Figure 8. fNIRS channels design, 8×8, for motor cortex. S, source; D, detector.

PLOS ONE

RESEARCH ARTICLE

Mutual interaction between motor cortex activation and pain in fibromyalgia: EEG-fNIRS study

Eleonora Gentile[1]*, Antonio Brunetti[2], Katia Ricci[1], Marianna Delussi[1], Vitoantonio Bevilacqua[2], Marina de Tommaso[1]

1 Applied Neurophysiology and Pain Unit, SMBNOS Department, Bari Aldo Moro University, Polyclinic General Hospital, Bari, Italy, 2 Department of Electrical and Information Engineering, Polytecnic University of Bari, Bari, Italy

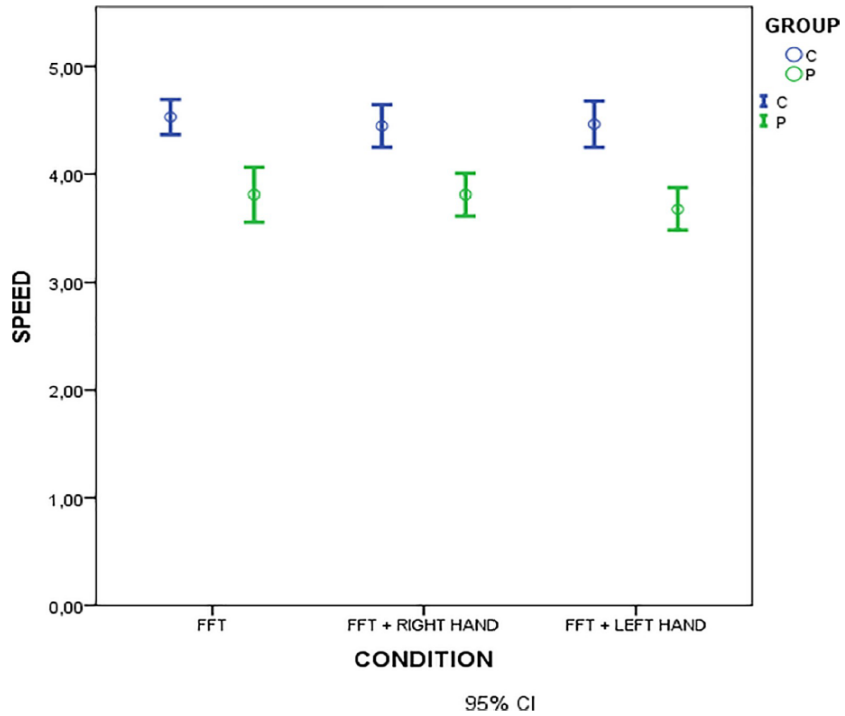
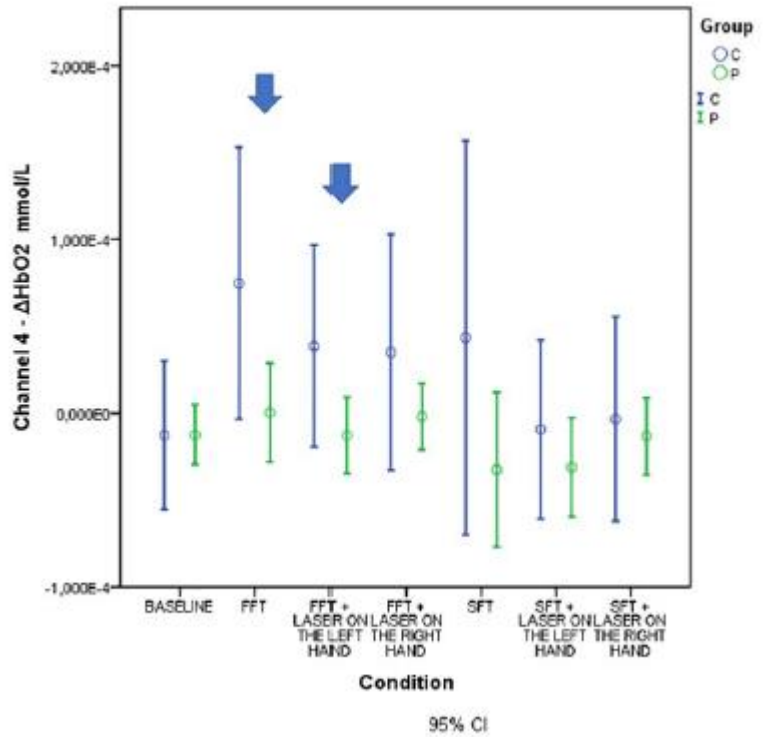
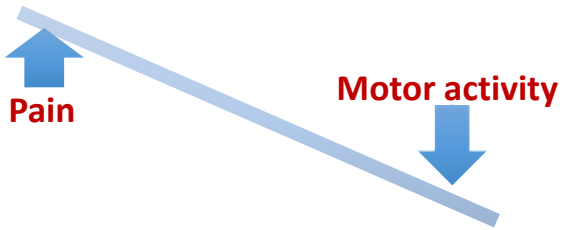


Fig 3. Mean values of finger tapping speed in motor task conditions in patients (green) and controls (blue). Statistical comparison is reported in Table 2.

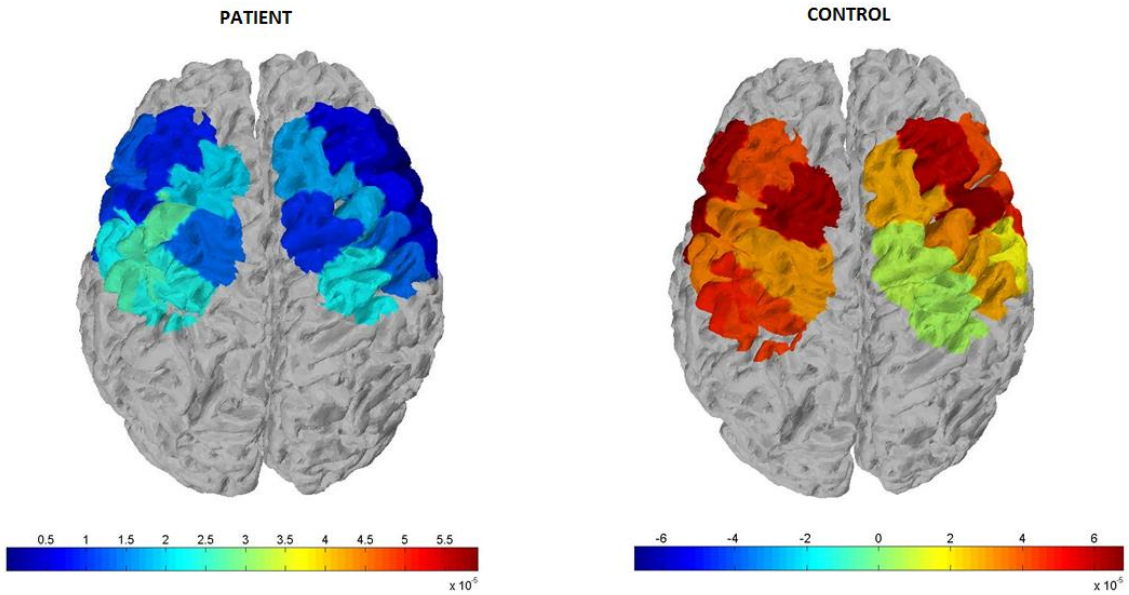
Finger tapping speed<in FM

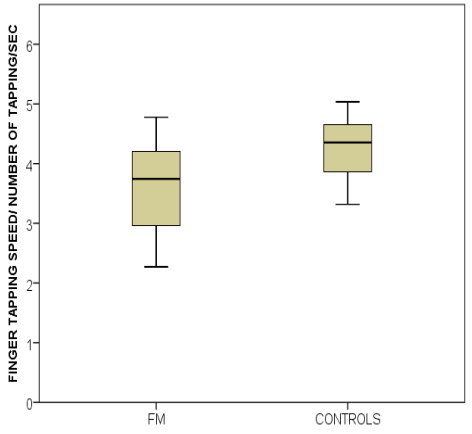


Oxyhemoglobin levels< in FM

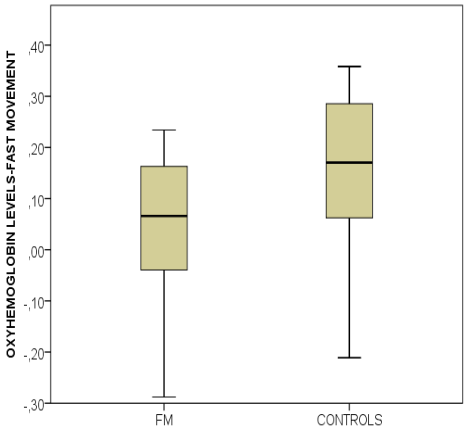


Nonostante la variabilità interindividuale, la tendenza ad una diversa modalità di attivazione corticale emerge con chiarezza nei singoli casi e nei gruppi

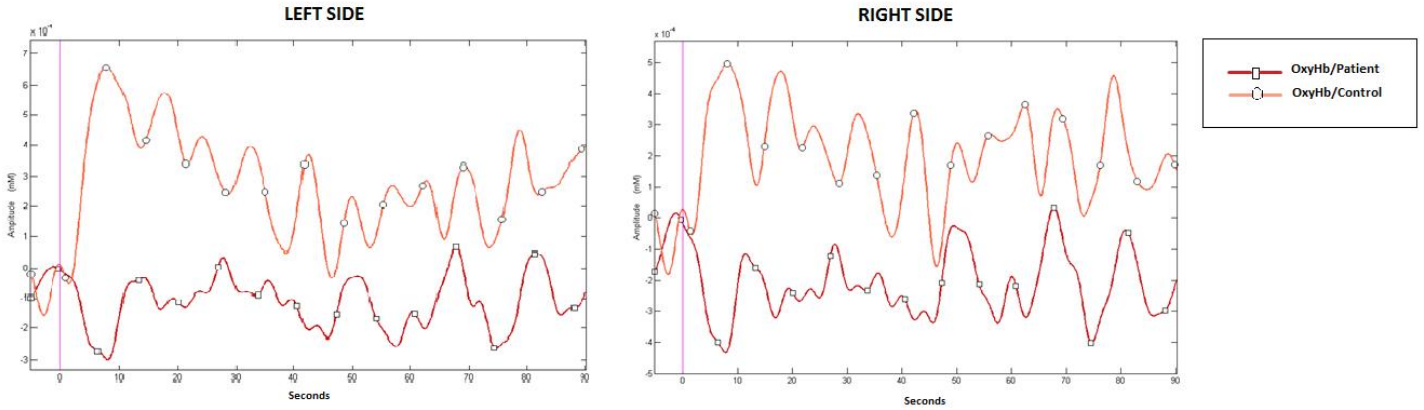


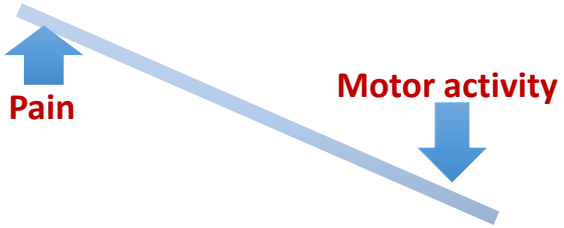


A)



B)





brain sciences

MDPI

Article

A Simple Pattern of Movement Is Not Able to Inhibit Experimental Pain in FM Patients and Controls: An sLORETA Study

Eleonora Gentile [1,*], Katia Ricci [1], Eleonora Vecchio [1], Giuseppe Libro [1], Marianna Delussi [1], Antonio Casas-Barragàn [2] and Marina de Tommaso [1]

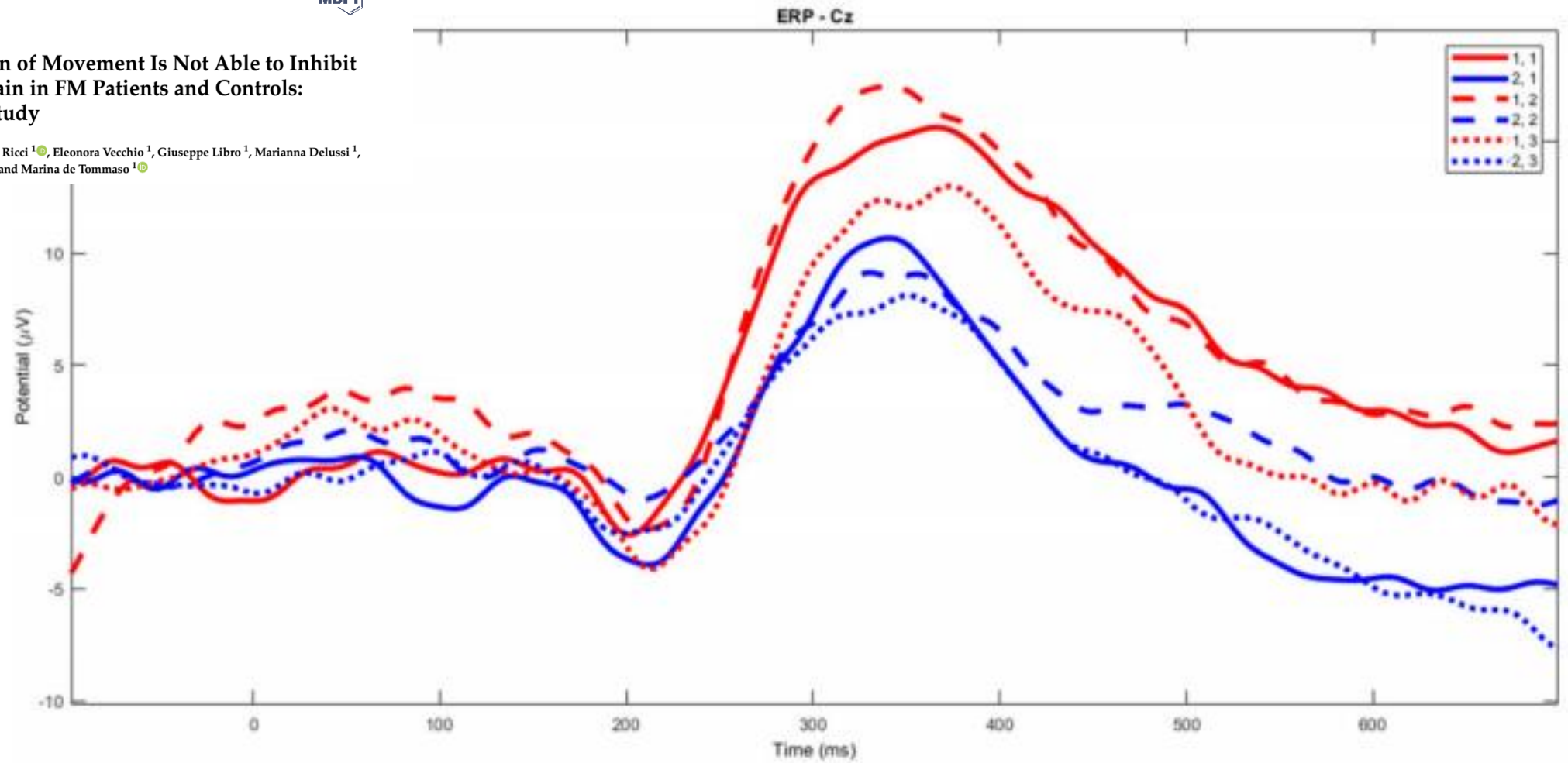


Figure 2. The grand average of the laser–evoked potentials on the right hand stimulation. The control group's basal condition (1,1), slow finger tapping (1,2) and fast finger tapping (1,3); the fibromyalgia (FM) group's basal condition (2,1), slow finger tapping (2,2) and fast finger tapping (2,3) (see also Figure 1).

- Poor modulation of LEP responses during the finger tapping task.
- (?)
- Poor cognitive engagement during simple repetitive movement.
- (?)

Could a more complex motor task, such as a finalized action, have a modulatory effect on pain condition?

scientific reports

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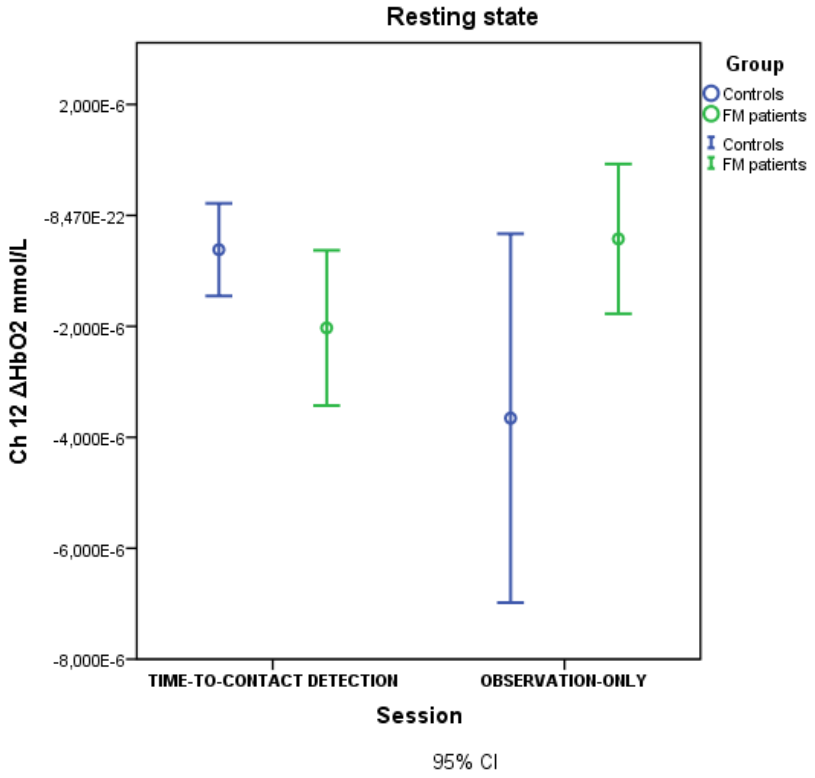
Movement observation activates motor cortex in fibromyalgia patients: a fNIRS study

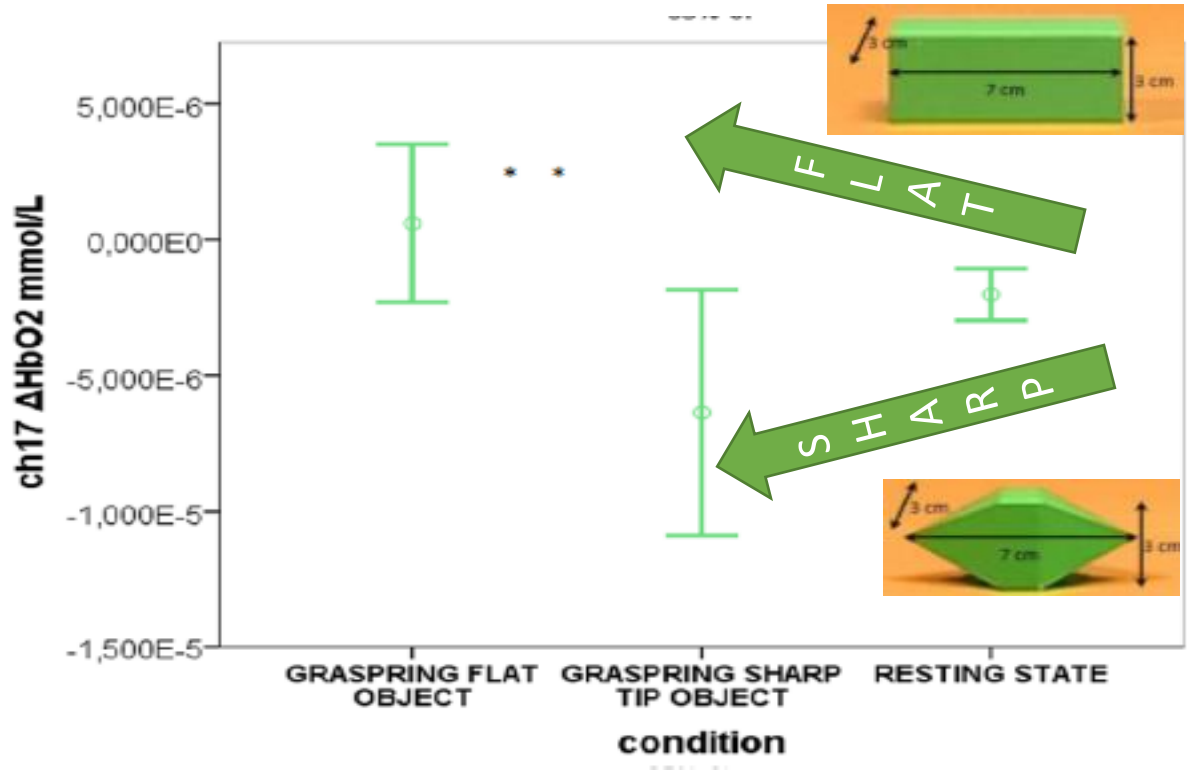
Eleonora Gentile[1]✉, Antonio Brunetti[2], Katia Ricci[1], Vitoantonio Bevilacqua[2], Laila Craighero[3] & Marina de Tommaso[1]

In resting state the motor network is activated in patients before the motor observation task, while in controls we observe cortical activation in preparation of active movement



In patients with chronic pain, the preparation to movement observation increases cortical metabolism

In FM patients, congruent grasping increased more efficiently cortical metabolism



The oxyhemoglobin levels went up in FM patients during congruent movement observation in respect to controls

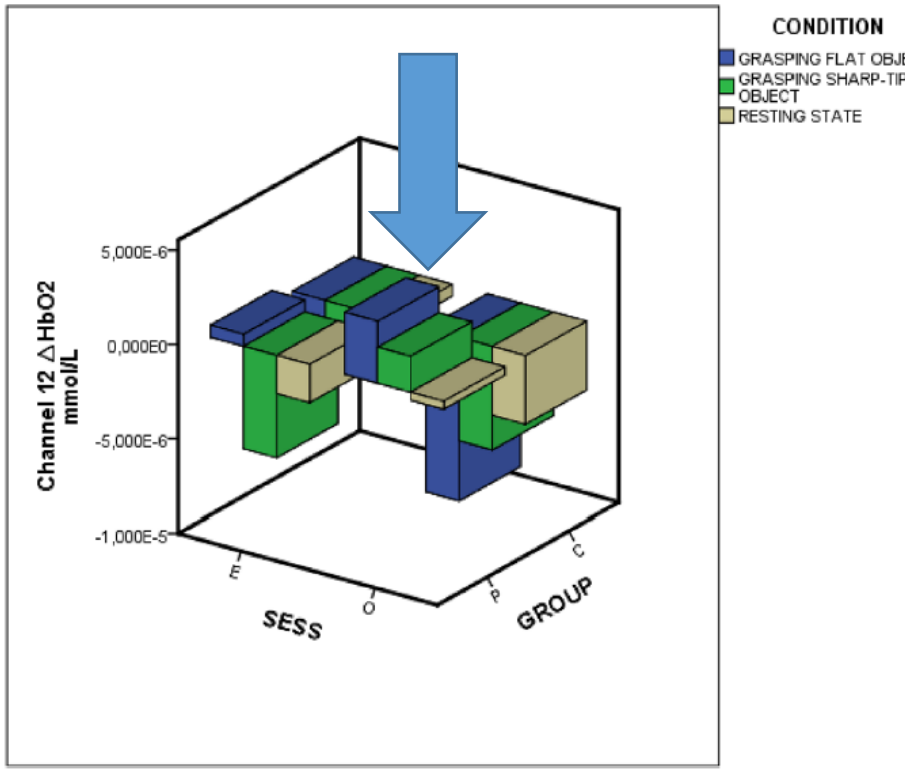


Figure 4. Oxyhemoglobin levels on an exemplificative channel (channel 12). *Sess* session, *O* obser session, *E* time-to-contact detection session, *P* FM patients, *C* controls.

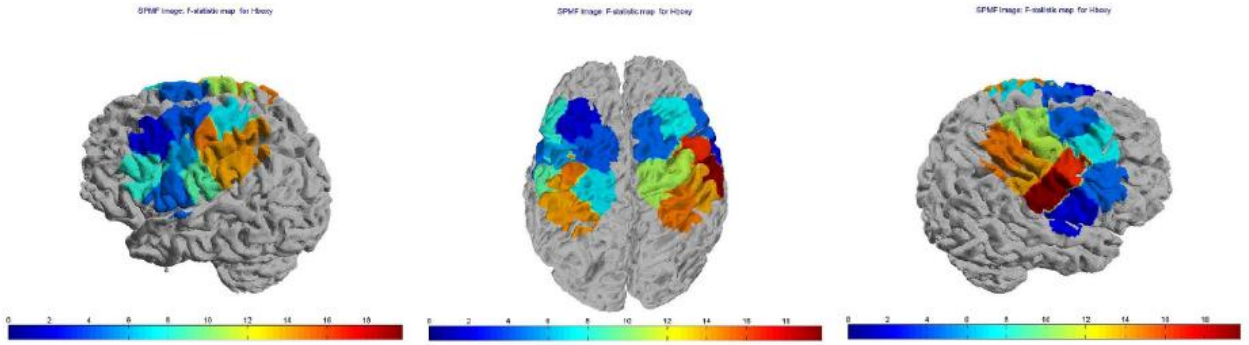


Figure 6. Topographic maps of F-statistic in the comparison among session (Time-to-contact detection vs Observation-only) and groups (FM patients vs controls). Blue areas represent channels with no significant change in hemoglobin levels, red areas represent channels where the variations in hemoglobin levels were significant.

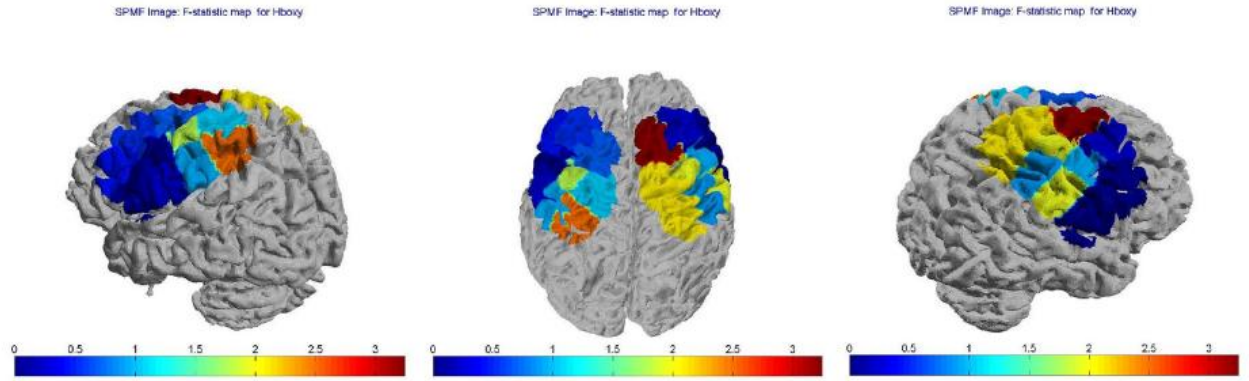


Figure 7. Topographic maps of F-statistic in the comparison among groups (FM patients vs controls) and conditions (Resting State vs Grasping Flat vs Grasping Sharp-tip object). Blue areas represent channels with no significant change in hemoglobin levels, red areas represent channels where the variations in hemoglobin levels were significant.

Similar results in Parkinson's disease: congruent movement observation drives up dysfunctional cortical motor networks

scientific reports

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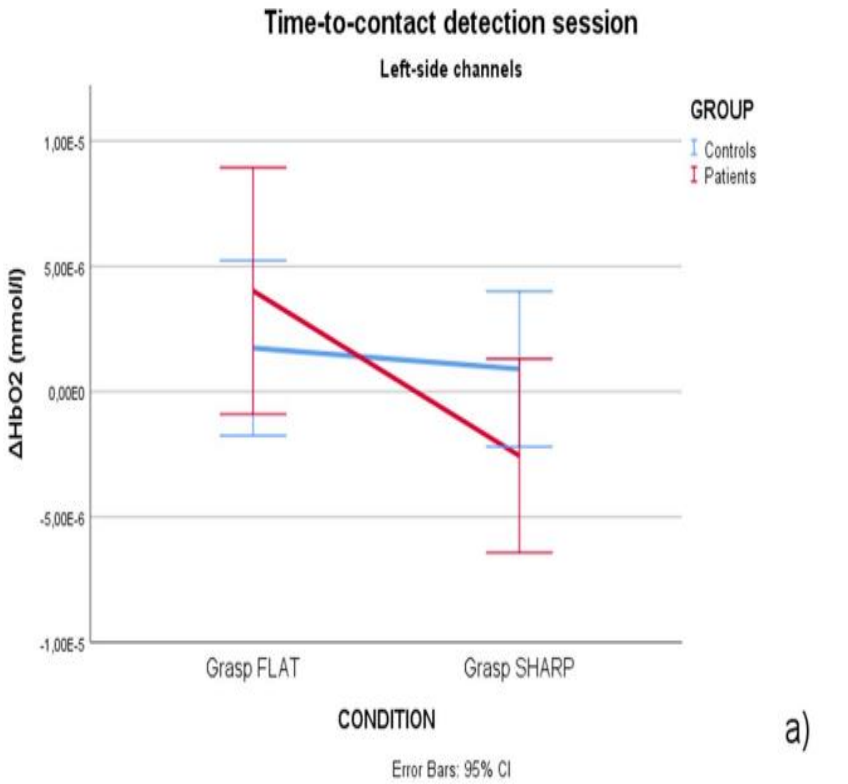
Effects of movement congruence on motor resonance in early Parkinson's disease

Eleonora Gentile[1,4], Antonio Brunetti[2,4], Katia Ricci[1], Eleonora Vecchio[1], Carlo Santoro[1], Elena Sibilano[2], Vitoantonio Bevilacqua[2], Giovanni Iliceto[1], Laila Craighero[3] & Marina de Tommaso[1]



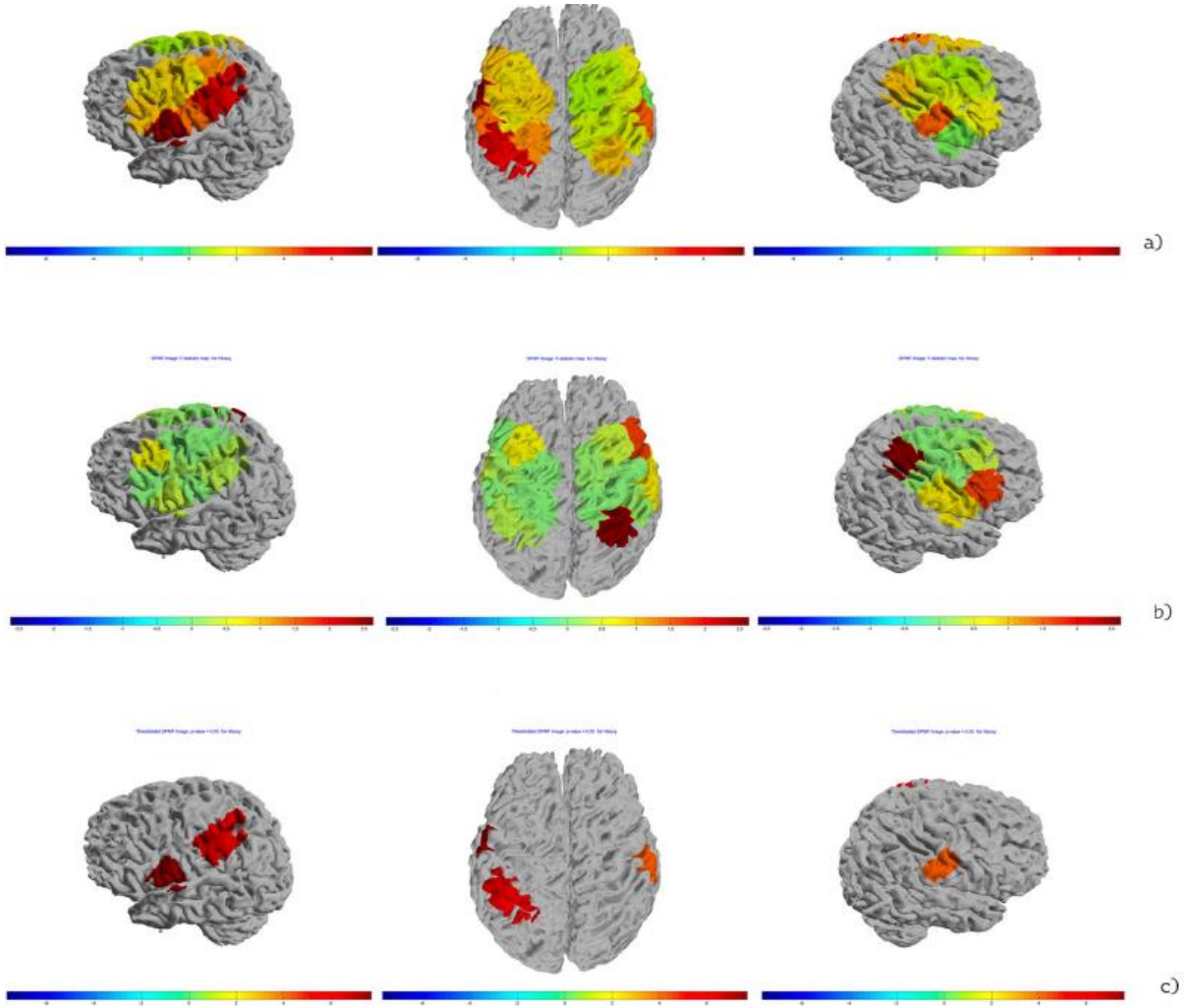
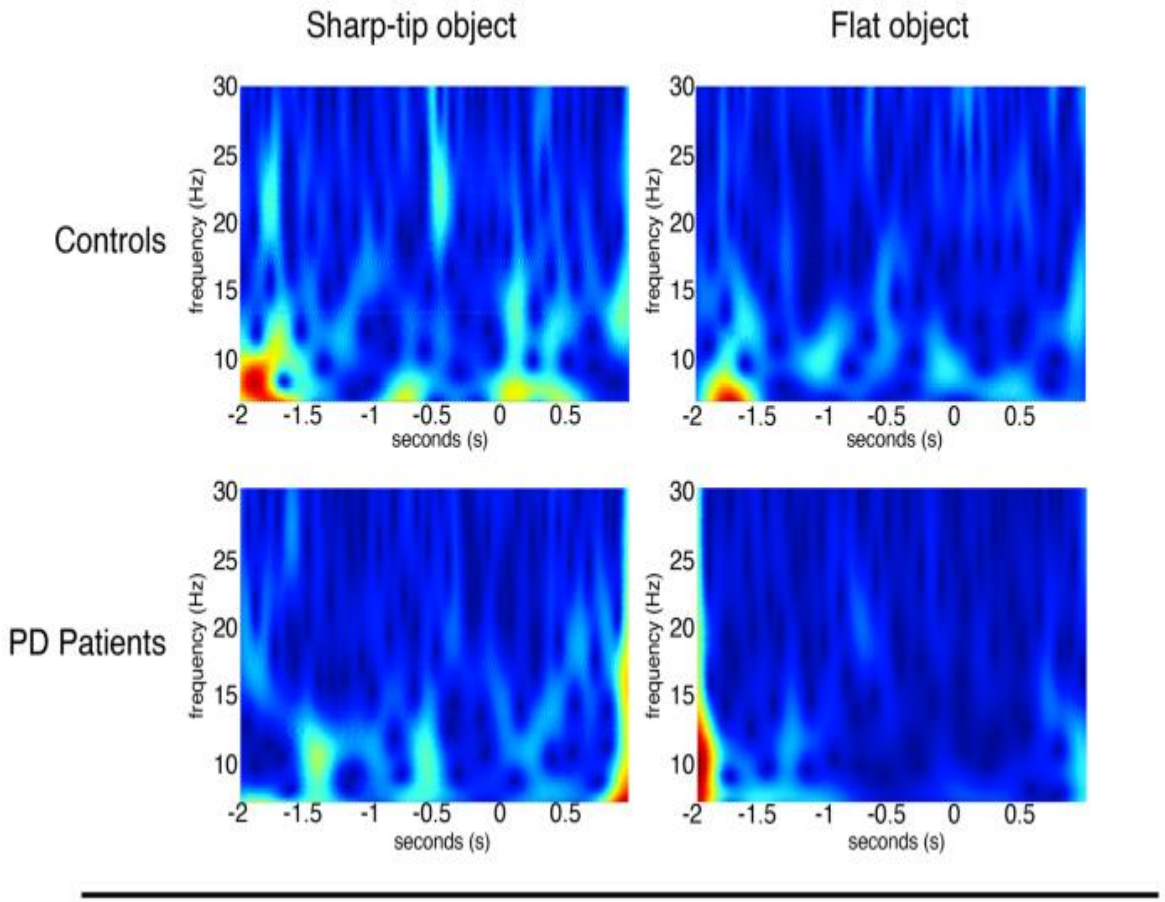


Figure 3. Topographic maps of the F-statistic in the comparison between conditions (Grasping Flat vs Grasping Sharp-tip object) in the PD patients (**a**) and controls (**b**) in Time-to-contact detection session. In (**c**) a particular of the F-statistic for the significant channels (Ch 7, Ch 8, Ch 10, $p < 0.05$) in the comparison between conditions (Grasping Flat vs Grasping Sharp-tip object) in the PD patient group for the time-to-contact session is reported. The color map represents the value of the F-statistic.

PD

C

PD



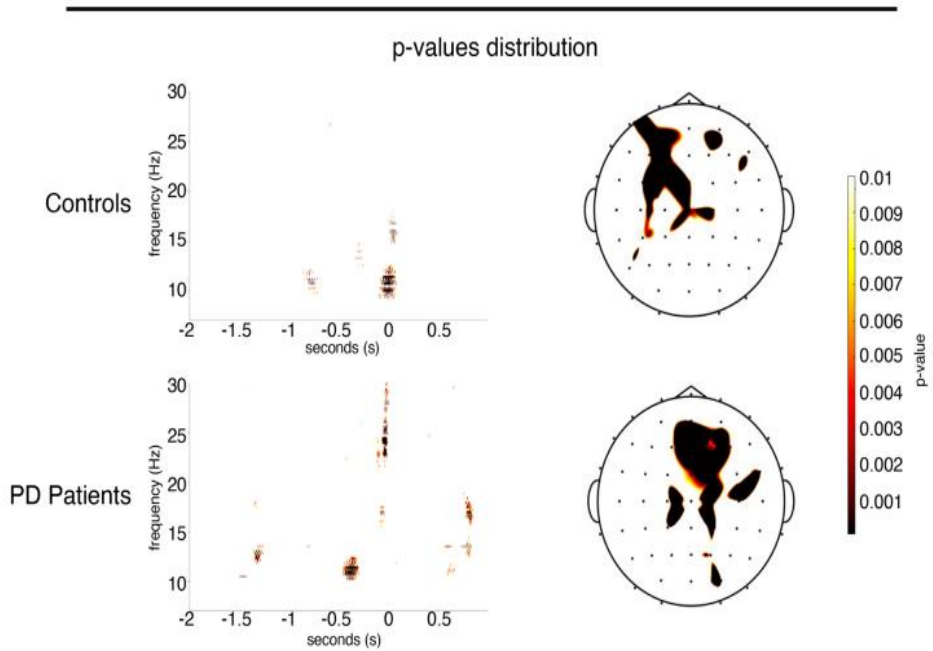
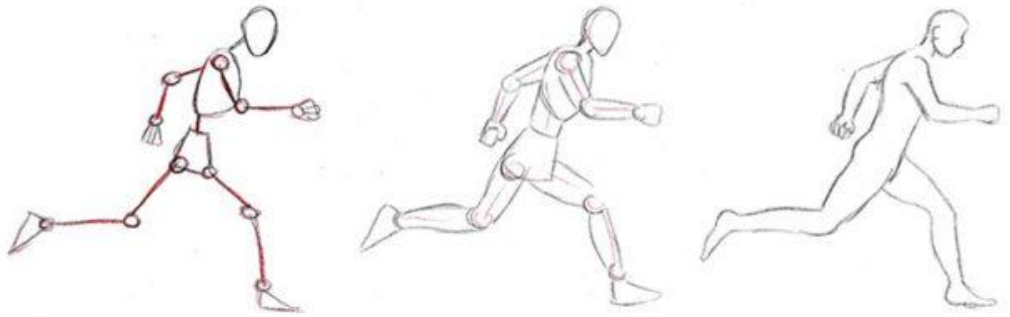


Figure 6. Time-to-contact detection session: comparison between flat vs sharp-tip object. (Up) The Grand Average of time–frequency analysis of alpha-mu recorded on the C3 derivation in the 2 s preceding and 1 s following the flat and sharp-tip object grasping are reported for controls and PD patients. (Bottom) For each group, the *p*-values obtained with paired t-test between flat vs sharp tip object are reported on the C3 channel, and on the statistical map. Before the flat object trials, we observed that alpha-mu desynchronization prevailed in the 8–9.5 Hz range in the 2 s time in controls, and in the 1 s time in the 11–13 Hz range in PD patients.

…to conclude….work in progress…



Active motor resonance mechanisms seem preserved in patients with possible initial failure in motor programming

Dysfunctional motor circuits seem to be modulated by congruent movement observation

Based on the present results, we could suppose that modifying the content of action observation, in order to stimulate motor resonance with the use of congruent movement, could improve the efficacy of rehabilitation strategies.