



# Task-oriented upper limb motor rehabilitation in progressive MS: Study design and preliminary results



E. Sbragia<sup>1</sup>, G. Boffa<sup>1</sup>, A. Tacchino<sup>2</sup>, N. Piaggio<sup>1</sup>, G. Bommarito<sup>1</sup>, G.L. Mancardi<sup>1</sup>, G. Brichetto<sup>2</sup>, M. Inglese<sup>1,3</sup>

<sup>1</sup> Department of Neuroscience, Rehabilitation, Ophthalmology, Genetics, Maternal and Child Health University of Genova, IRCCS AOU San Martino-IST; <sup>2</sup> Italian Multiple Sclerosis Foundation, Scientific Research Area; <sup>3</sup> Department of Neurology and Neuroscience, Icahn School of Medicine at Mount Sinai, New York

## BACKGROUND

Upper limb motor dysfunction is very common in multiple sclerosis (MS), interfering with daily living activities and worsening quality of life [1]. Neuro-rehabilitation may be a particularly useful approach, since treatment options are limited. It has been previously demonstrated [2] that active task-oriented upper limb motor rehabilitation treatment in relapsing remitting (RR) MS has an impact both on motor performance and on MRI-derived metrics of white matter integrity compared to passive exercises. However, there is no evidence about the utility of this treatment in patients with progressive MS.

## AIMS

The aim of our study is to evaluate the clinical response and the MRI-derived metrics to task-specific oriented rehabilitation strategy in progressive MS patients. Here we report the study design and baseline demographic, clinical and radiological characteristics of patients enrolled in the study.

## MATERIALS AND METHODS

### Experimental design

Inclusion criteria:

- a) age: 18-65 years; b) EDSS  $\leq$  6.5

Exclusion criteria:

- a) mini-mental state examination (MMSE)  $\leq$  26
- b) modified Ashworth scale  $>$  3 in at least 2 muscle groups
- c) history of cardiovascular, respiratory, orthopedic, psychiatric conditions precluding participation
- d) MRI contraindications

Patients will receive 36 one-hour treatment sessions, three times a week for 2 months.

Clinical and behavioral data will be recorded at baseline and will be collected after the rehabilitation treatment (T1) and at 12 month follow-up (T2).

Distal and proximal upper limb motor performance, dexterity and perceived motor performance will be evaluated in all patients by the following standard measures:

- a) action research arm test (ARAT)
- b) nine Hole Peg Test (9-HPT)
- c) ABILHAND
- d) Arm function in multiple sclerosis questionnaire (AMSQ)

At the same time points (baseline, T1 and T2), all subjects will undergo brain MRI (1.5 T GE) with the following protocol:

- a) axial DP-T2-4 mm;
- b) 3D-T1- weighted SPGR (voxel size 1 mm<sup>3</sup>)
- c) DTI with diffusion gradients applied along 61 directions
- d) T2\*-weighted EPI for resting state (rs)-fMRI with closed eyes

### MRI Analysis

As gold-standard, lesion masks were manually outlined on T2-DP and 3DT1-images using the software package Jim (v 7.0).

Normalized brain volume (NBV), Grey (GM) and White Matter (WM) volumes were obtained with Sienax [3].

### Statistical analysis

All statistical analysis were performed using SPSS (v. 21.0)

## RESULTS

DEMOGRAPHIC CHARACTERISTICS	
Mean age, y	55 $\pm$ 12
F / M	8 / 1
Median EDSS (range)	4.5 (4-7.5)
Mean disease duration, y	22 $\pm$ 12
PPMS / SPMS	1 / 8

MRI CHARACTERISTICS (mean $\pm$ SD)	
T2 lesion volume, mL	40 $\pm$ 25
T1 lesion volume, mL	29 $\pm$ 20
Normalized brain volume, mL	1189 $\pm$ 115
Normalized white matter volume, mL	566 $\pm$ 62
Normalized grey volume, mL	623 $\pm$ 73

FUNCTIONAL CHARACTERISTICS (mean $\pm$ SD)	
Symbol digit modalities test (SDMT)	35 (11)
Right Nine-hole-peg-test (9-HPT)	42 (52)
Left Nine-hole-peg-test (9-HPT)	40 (29)
ABILHAND	38 (12)
AMSQ	49 (19)

- 6 patients were assigned to the task-oriented rehabilitation treatment, 2 patients to the passive rehabilitation group and 1 patient was included in the control group
- Only 5 patients reached T1 time-point

## DISCUSSION AND CONCLUSIONS

- Enrollment of Progressive MS patients showed to be extremely difficult
- Main reasons for declining the rehabilitative treatment were: problems in reaching the rehab-center; comorbidities; mistrust in motor improvement
- Main reasons for drop-out were: job commitment and demanding study design
- We have addressed the enrollment issues adopting the following strategies:
  - reducing the treatment period from 3 to 2 months
  - offering home treatment when preferred by the patients
  - including other clinical centers in Genoa
- The study is ongoing and, if successful, will provide relevant clinical and biological information about the impact of task-oriented rehabilitation in progressive MS

## REFERENCES

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- [3] Smith, S.M. et al. "Accurate, robust and automated longitudinal and cross-sectional brain change analysis." *Neuroimage*, 2002

