# Effects of rehabilitation treatment of the upper limb in Multiple Sclerosis patients and predictive value of neurophysiological measures

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## OBJECTIVES

Dysfunctions of the upper limbs occur in 66% of Multiple Sclerosis (MS) patients. To date, no data, about the persistence of the effects of a rehabilitation treatment and no prognostic markers of functional improvement, have been established. The aim of our study is finding them to help us identifying patients who could have a better response to a specific rehabilitation program.

## METHODS

Twenty-five consecutive patients affected by relapsing remitting or secondary progressive MS, in a stable fase of the disease for the previous 6 months, attending the MS centers of Rome and Siena, were tested for eligibility (Table 1 and 2). They underwent a 16-weeks rehabilitation period consisting of two 55-minute sessions of motor rehabilitation every day and were neurologically evaluated in three consecutives visite: Baseline (T0), after the 16-weeks rehabilitation program (T1) and at the end of the following 12-week post-rehabilitation period (T2). At each visit they underwent a complete neurological examination including EDSS score, Modified Ashworth Scale for spasticity of upper limbs, the 9-hole peg test (9-HPT), the Disabilities of the Arm, Shoulder and Hand (DASH) Questionnaire, the 36-item Short-Form Health Survey (SF-36), the Fatigue Severity Scale (FSS), the Beck Depression Inventory (BDI) and finally recorded somatosensory evoked potentials (SEP) of the upper limbs (Table 3).

| | | Total Patients | |
|---|---|---|---|
| | | N | % |
| Patients | | 25 | / |
| Sex | | | |
| | Men | 13 | 52% |
| | Women | 12 | 48% |
| Type of MS | | | |
| | RR-MS | 10 | 40% |
| | SP-MS | 15 | 60% |
| Therapy | | | |
| | IFNβ | 11 | 44% |
| | Glatiramer Acetate | 3 | 12% |
| | Azathioprine | 1 | 4% |
| | No Therapy | 10 | 40% |
| Concomitant sensory disturbances in upper arms | | | |
| | Yes | 6 | 24% |
| | No | 19 | 76% |

| | Total Patients | |
|---|---|---|
| | Average | SD |
| Age (years) | 51,9 | 13,2 |
| Lenght of disease (years) | 10,8 | 6,9 |
| EDSS score | 5 | 2,0 |
| FSS score | 3,9 | 1,7 |
| BDI score | 8,4 | 6,9 |

**Table 1 and 2:** characteristics of the sample of patients

| | Left Side | Right Side |
|---|---|---|
| SSEPs, n normal:abnormal:absent | 11/13/1 | 10/14/1 |
| P14, ms | 16.28 (2.33) | 15.98 (1.51) |
| N20, ms | 21.19 (2.67) | 20.42 (2.04) |
| N9-P14, ms | 6.21 (1.85) | 6.16 (2.10) |
| P14-N20, ms | 4.91 (0.82) | 4.45 (0.84) |

**Table 3:** Neurophysiological features at baseline visit

## RESULTS

We found a significant improvement of the 9-HPT at both sides, not only at the immediate post-training visit T1 (left: p=0.018, right: p=0.004), but also at the 12-week post-intervention assessment visit T2 (left: p=0.033, right: p=0.022). The DASH score also significantly improved at either immediate post-training visit T1 (p=0.002) and at the post-intervention visit T2 (p=0.007). Furthermore we found a significant improvement in the Physical Composite Score of SF-36 at either visit T1 (p=0.005) and visit T2 (p=0.01) (Figure 1). On top we found a positive correlation between the 12-week post-training change in 9HPT and the N14-P20 interpeak of SEP (rho=0.374, p=0.008) (Figure 2), indicating that there was a reduced carry over effect of the rehabilitation-induced improvement of manual dexterity in those patients who presented a more delayed central conduction time from the lower brain-steam to the cortex. The partial lack of an appropriate sensory feedback during upper limb rehabilitation, as reflected by the delayed latency of N14-P20 interpeak, might have prevented functional adapting changes in partly "deafferented" sensorimotor areas to occur, thereby contributing to functional disability.

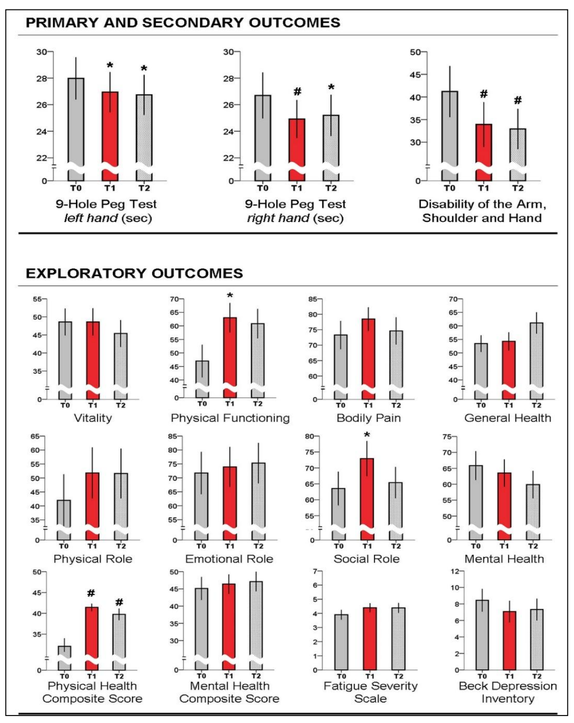


**Figure 1** Primary and Secondary Outcomes at T0, T1 and T2

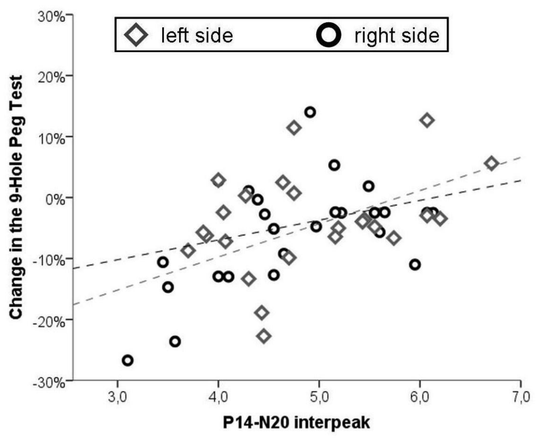


**Figure 2:** Correlation between the change in the 9-Hole Peg test and P14-N20 Interpeak

## CONCLUSIONS

Our study demonstrates that rehabilitation treatment can lead to an improvement of the upper limb motor performance in MS patients which persists after 3 months of treatment-discontinuation further suggesting a possible role of rehabilitation in neuroplasticity changes. Moreover, we found in **the latency of N14-P20 interpeak a possible prognostic marker of rehabilitation treatment effect** on the upper limb in MS patients.

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