

Propose for a new measure of cognitive fatigability derived from Symbol Digit Modalities Test: the Information Processing Speed Deceleration Index (IPSDI)

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Background

Fatigability is defined as an objective change while performing a motor or cognitive task, and is one of the most debilitating symptoms of multiple sclerosis (MS) (1). Few techniques have been developed to objectively measure cognitive fatigability (CF), and a widely accepted method is still lacking (2-3).

Objectives: to find an easy tool to measure CF, based on the Symbol Digit Modalities Test (SDMT) (4), and to investigate its correlation with subjective fatigue

Methods

We included 55 (34 F, 25 M) patients with MS aged between 18 and 65 years, and 44 (25 F, 20 M) healthy subjects (HS) to be used as controls. The SDMT was administered twice in a row (SDMT1 and SDMT2), recording the number of correct answers (NCA) for each test in 3-time intervals (time-1: 0-30 s; time-2: 30-60 s; time-3: 60-90 s).

We estimated the "Information Processing Speed Deceleration Index" (IPSDI) with the following equation:

$$\text{Information Processing Speed Deceleration Index (IPSDI)} = \frac{(\text{NCA time1} - \text{NCA time3})}{\text{NCA time1}} * 100$$

The Modified Fatigue Impact Scale (MFIS)(5) was also administered to patients. Repeated Measures ANOVA was used to test the time by group effect in NCA in the two consecutive trial of SDMT, differences in IPSDI at SDMT1 and 2 were tested with unpaired t-tests. Relationship between IPSDI and MFIS was investigated by the Spearman coefficient.

Results

We did not find significant differences between MS and HS in female/male ratio (F:M 35:25 vs 25:20), age (44.9±10.10 vs 44.3±12.8 years) educational level (14.3±3.1 vs 13.9±3.5 years) p>0.5. Mean disease duration for MS patients was 11.9± 8.9, median EDSS score 3.5, range 1-6. As expected, MS performed worse than HS in terms of mean NCA at both SDMT1 (34.9±/-14.1 vs. 50±/-13.5, p<0.001) and SDMT2 (36.2±/-14.2 vs. 51.4±/-11.4, p<0.001). However, considering the NCA at different time-points, we did not find a significant time by group interaction at SDMT1 (F=1.32, p=0.3); by contrast, we found a significant time by group interaction (F=4.28, p=0.015) at SDMT2, indicating that NCA decreased over time only in MS (FIGURE1). We also found a significant difference in MS and HS in mean IPSDI at SDMT2 (3.4±/-25.3, vs -6.8±/-24.4 p=0.045) (FIGURE2), while difference in mean IPSDI at SDMT1 did not reach the statistical significance (-0.2±/ 33, vs 9.4 ±/-20 p=0.1). Lastly, in MS group, IPSDI at SDMT2 was significantly correlated with MFIS total score (rho=-0.461; p<0.001) and its subscales (physical rho=-0.447, p<0.001; cognitive rho=-0.315; p=0.019; psychological rho=-0.376 p=0.005) (FIGURE3) no correlation were found between IPSDI at SDMT1 and MFIS scores.

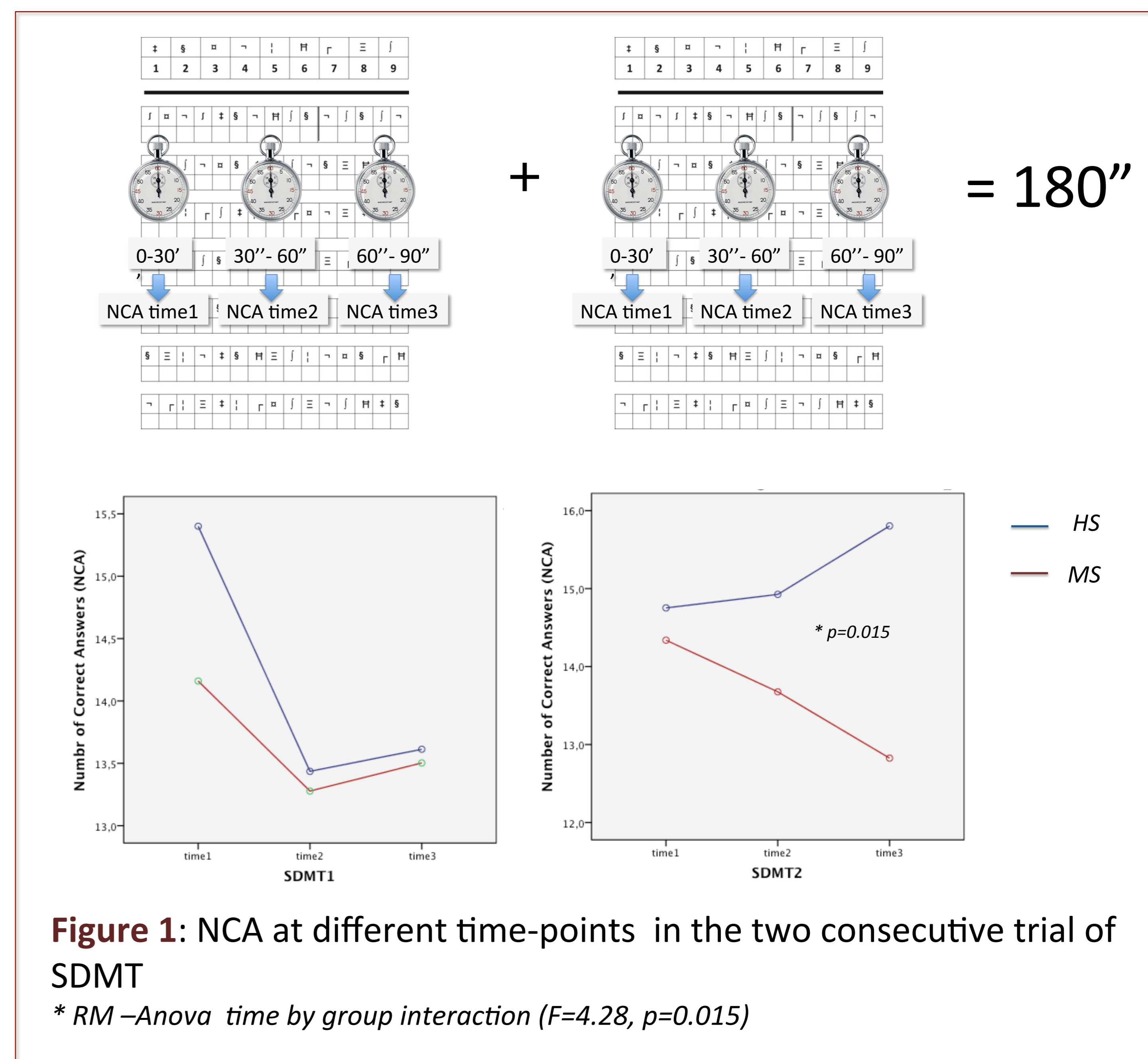


Figure 1: NCA at different time-points in the two consecutive trial of SDMT

* RM-Anova time by group interaction (F=4.28, p=0.015)

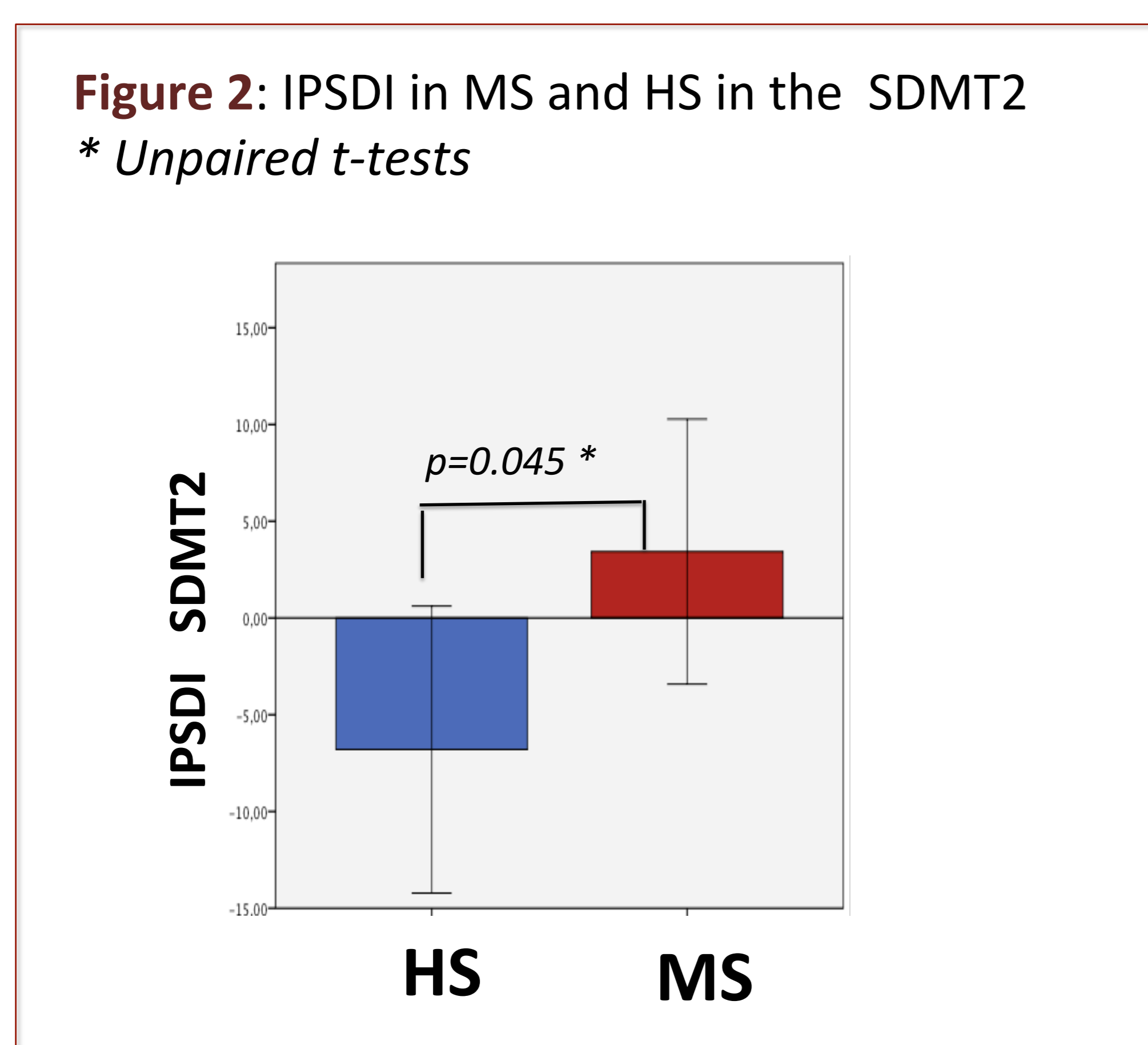


Figure 2: IPSDI in MS and HS in the SDMT2
* Unpaired t-tests

Conclusions

The administration of SDMT twice in a row may unmask the occurrence of cognitive fatigability in MS. We suggest that the IPSDI could be used as an easy tool to measure cognitive fatigability, further evaluations are needed to assess its validity and its relation with measures of subjective fatigue

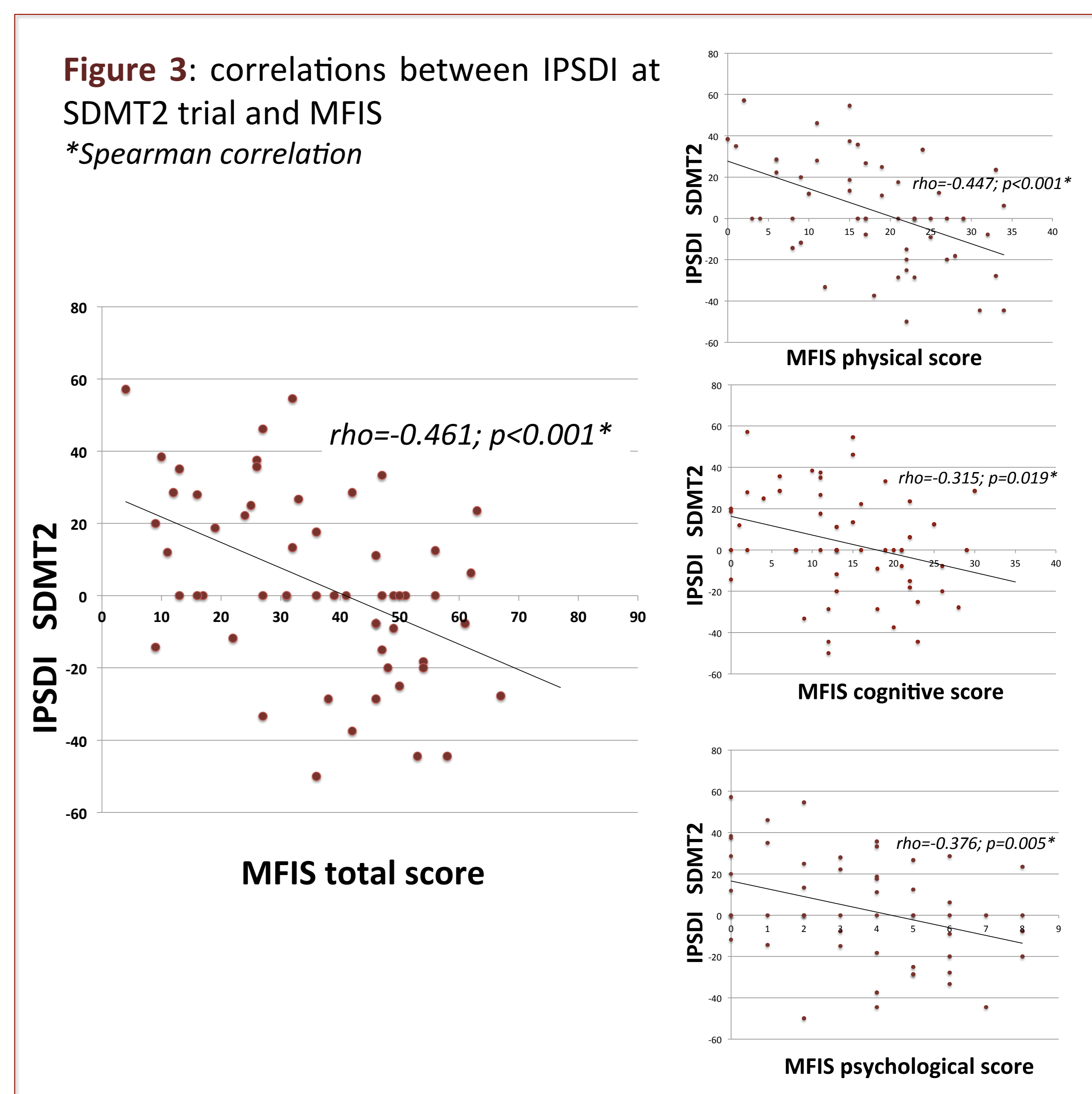


Figure 3: correlations between IPSDI at SDMT2 trial and MFIS
*Spearman correlation

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Disclosures

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