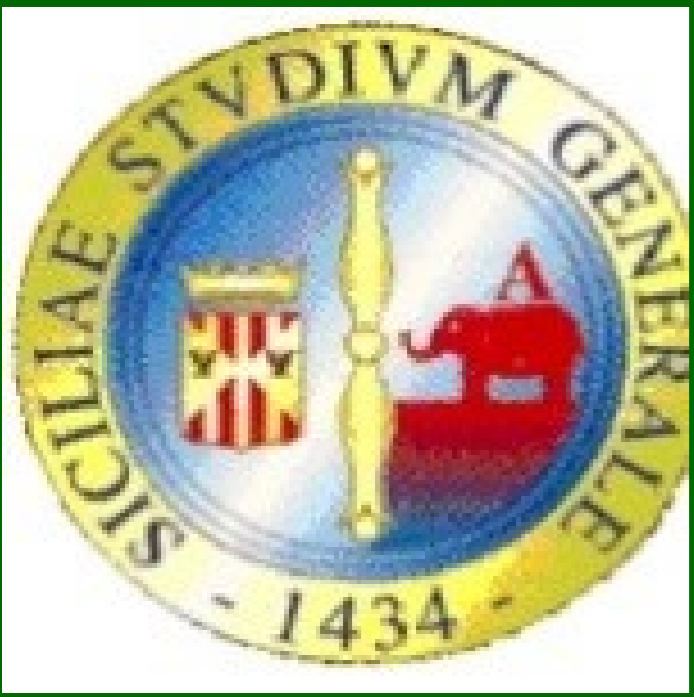# Modeling of upper limbs motor function in Multiple Sclerosis patients using movement time analyzer (MTA): a pilot study

**Clara G. Chisari, Floriana Giardina, Andrea Caramma, Salvatore Lo Fermo, Monia Papa, Francesco Patti, Mario Zappia**

Department "GF Ingrassia", section of Neuroscience, University of Catania, Catania, Italy.

**Introduction:** Movement time analyzer (MTA) is a computer-controlled tachistoscope for measuring the time needed for the execution of a prefixed movement. It has been used to objectively evaluate dopaminergic drug effect on upper limb motor function in Parkinson's disease patients. The aim of our study was to objectively investigate upper limb motor function in Multiple Sclerosis (MS) patients.

**Materials:** We screened 214 consecutive patients with MS diagnosis according to Mc Donald criteria, referred to Multiple Sclerosis Centre of the University of Catania in the period between 1st September 2016 and 30th April 2017. We also enrolled 35 healthy controls (HC) matched for sex, age and education level. Patients with neurological and/or orthopedic diseases potentially affecting upper limbs motility were excluded from the study

**Methods:** All patients underwent a complete neurological evaluation, Expanded disability status scale (EDSS), nine holes peg test (9-HPT), symbol digit modality test (SDMT) and MTA training sessions. This latter consisted of three tasks for each hand, dominant hand (DH) and no-dominant hand (nDH). Subjects held their index finger of the dominant/non-dominant hand over the central start button, and after the random appearance of one of the three peripheral stimulus lights, they had to switch the light off as quickly as possible by moving their finger from the central button to the corresponding illuminated button.

**Results:** Out of 214, 166 MS patients (mean age $38.9\pm12.6$, 61.4% women, mean EDSS $3.2\pm2.0$) were finally enrolled. One-hundred and twenty-four (74.7%) were relapsing MS (RMS), 42 (25.3%) were progressive (PMS). We found significant differences in MTA scores between MS and HC ($284.8\pm14.9$ vs $186.1\pm9.5$ msec, p<0.001 in DH, $300.1\pm19.4$ vs $197.8\pm13.4$ msec, p<0.001 in nDH). Among MS phenotypes, PMS showed worse performances in MTA compared to RRMS ($308.9\pm13.4$ vs $260.7\pm16.4$ msec, p<0.01 in DH, $326.3\pm20.5$ vs $274.8\pm18.3$ msec, p<0.01 in nDH). Positive correlations were found between MTA and age (r=0.83, p<0.01) and between MTA and 9-HTP score (r=0.72, p<0.01). No correlations were found between MTA and cognitive data.

**Discussion:** This is the first study using MTA for upper limb motor assessment in a large MS population. We found that MTA was able to objectively evaluate hand impairment in MS patients. Moreover MTA performances positively correlate with 9-HPT score.

Figure 1



*: <0.01

Figure 2



Figure 3



r=0.83
P<0.001

Figure 4



r=0.72
P<0.001
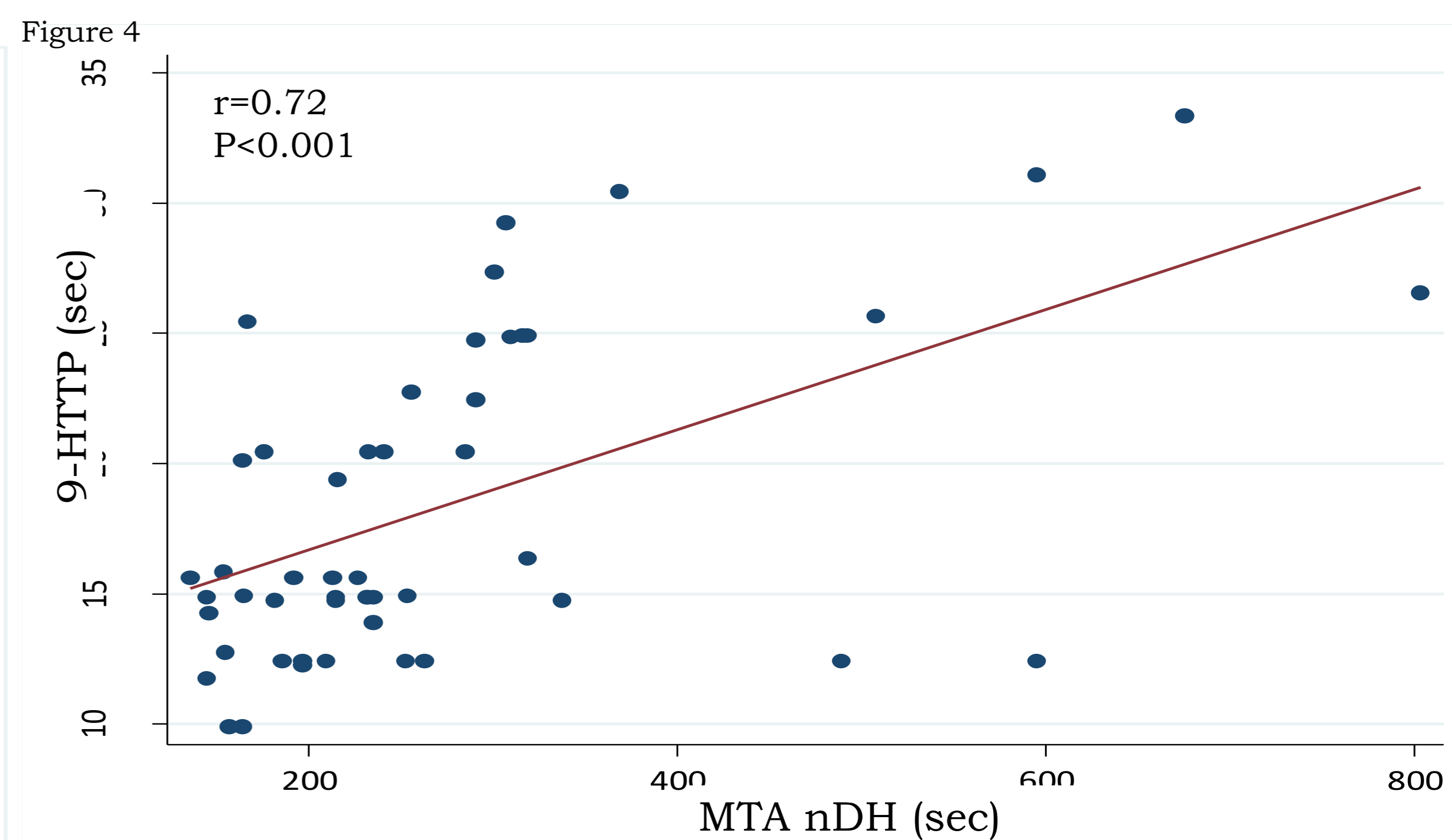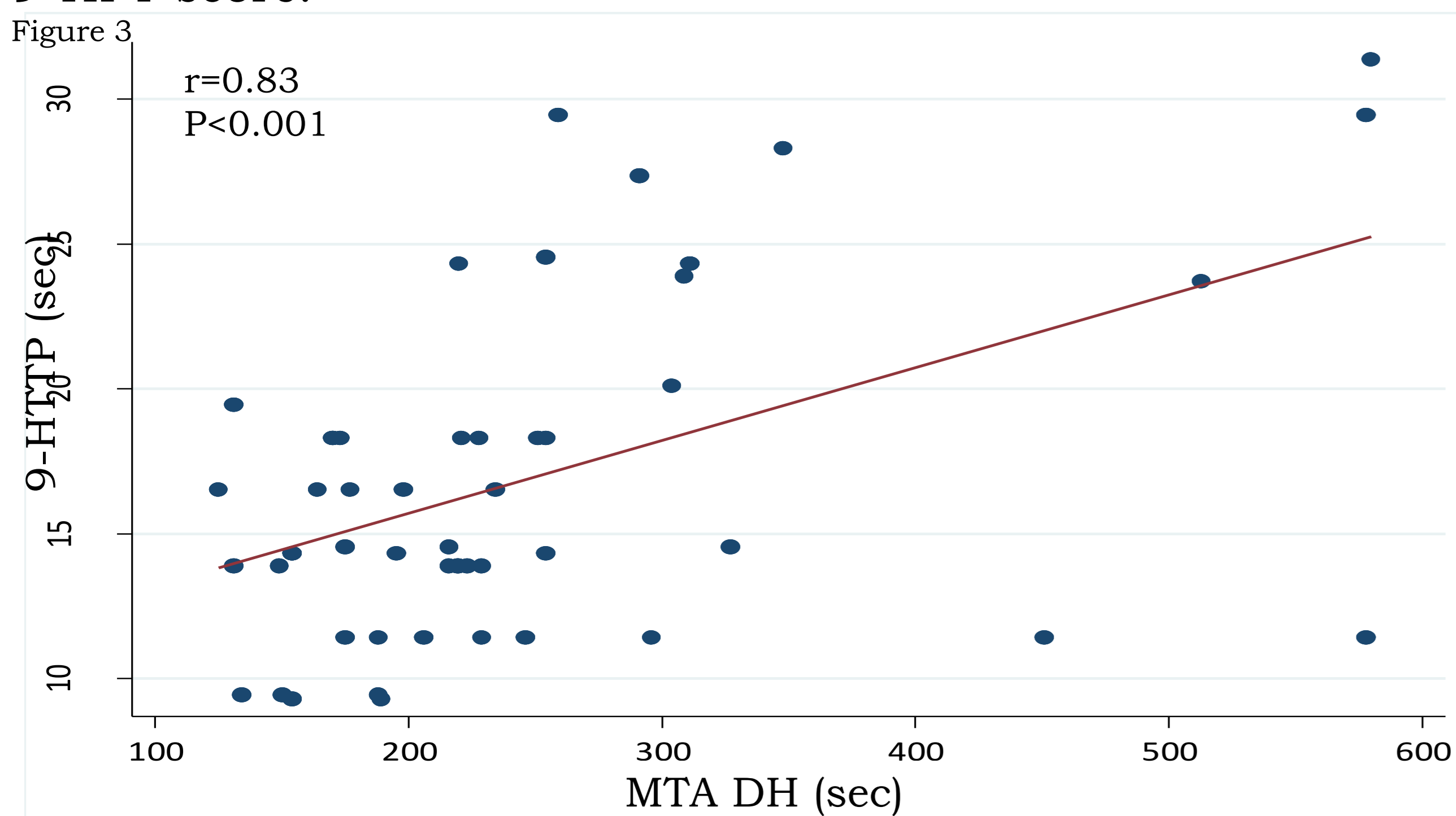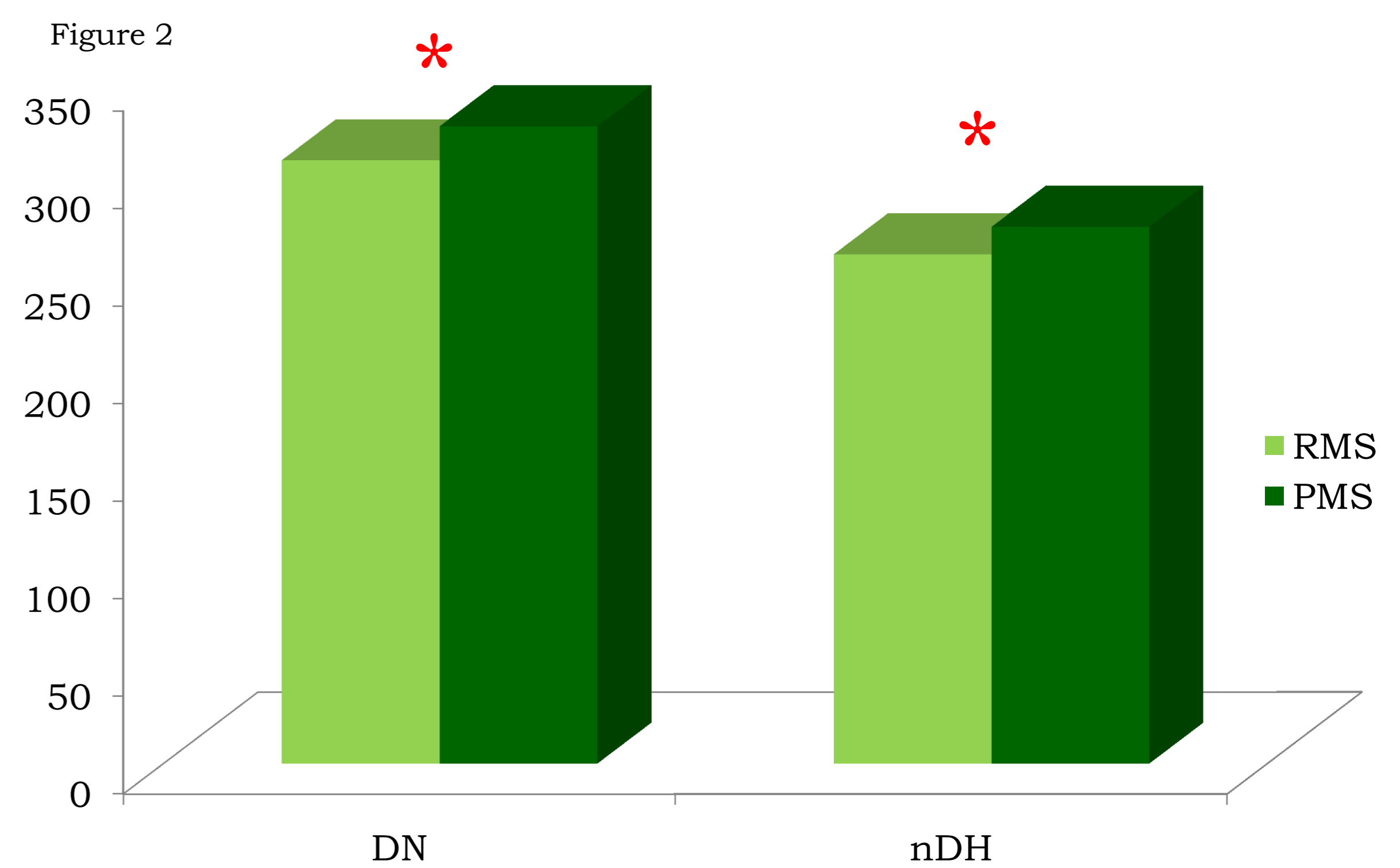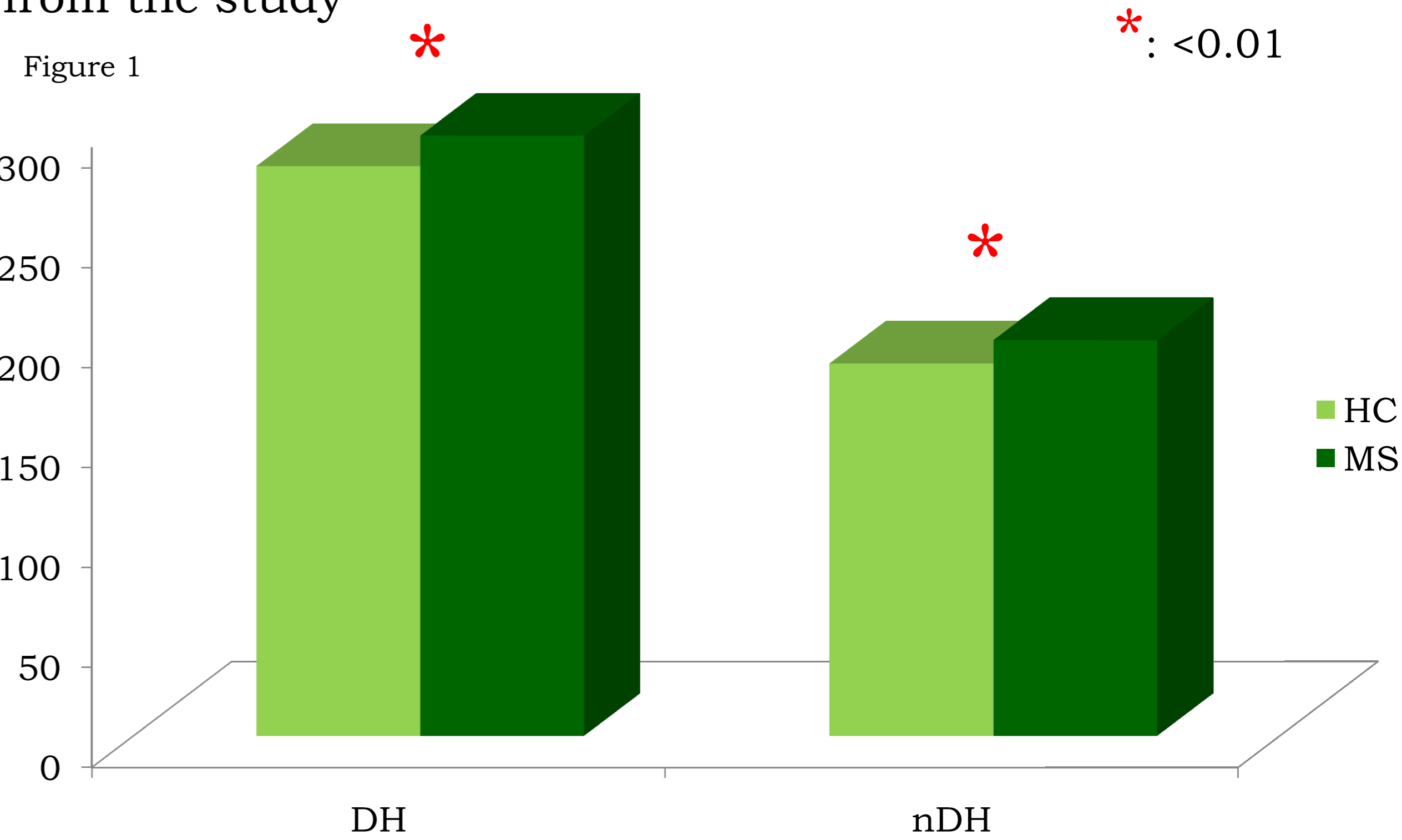
**Conclusion: This is the first study using MTA for upper limb motor assessment in a large MS population. We found that MTA was able to objectively evaluate hand impairment in MS patients. Moreover MTA performances positively correlate with 9-HPT score.**

Zappia M, Montesanti R, Colao R et al (1994) Usefulness of movement time in the assessment of Parkinsons'disease. J Neurol 241:543–550 ; Nicoletti G, Arabia G, Pugliese P et al (2005) Movement time and aging: a normative study in healthy subjects with the with the ''movement time analyzer''. Aging ClinExp Res 17:207–210 ; Zappia M, Montesanti R, Colao R et al (1997) Short-term levodopa test assessed by movement time accurately predicts dopaminergic responsiveness in Parkinson's disease. Mov Disord 12:103–106