P53

The velocity-dependent feature of rigidity in Parkinson's disease: evidence from a robot-assisted Study

<u>*Marco Falletti*</u> [1], F. Asci[2], A. Zampogna[1], V. D'Onofrio[1], M. Patera[1], A. Suppa[1-2]

[1]Department of Human Neurosciences, Sapienza University of Rome, Italy
[2]IRCCS Neuromed Institute, Pozzilli, Italy

Introduction: Several authors have considered the long-latency reflexes (LLRs) as the main pathophysiological hallmark of rigidity in Parkinson's disease (PD)[1,2]. Recently, specific biomechanical components, including the neural component (NC), have been identified to contribute to the rigidity in PD[3,4]. None has previously combined the biomechanical with the neurophysiologic recordings of muscle tone. Finally, none has explored the relationship between rigidity and angular velocity of muscle stretches in PD.

Objective: The aim of this study is to measure simultaneous changes in specific biomechanical and neurophysiologic components of rigidity in PD, during robot-assisted wrist extensions, at various angular velocities.

Methods: In this study, we recruited 16 PD patients and 25 age- and sex-matched healthy subjects (HS). Participants underwent an experimental paradigm based on the assessment of spinal (i.e., short latency reflex–SLR) and supraspinal reflexes (i.e., LLRs) as well as the three components of muscle tone (i.e., NC, viscous component - VC and elastic component - EC). We use a servomotor able to induce wrist-stretches at different velocities (i.e., 50, 100, 150, 200, 236 and finally 280°/sec). Simultaneously, we recorded the EMG activity of the stretched muscles. All PD patients were evaluated in OFF therapy with L-Dopa.

Results: We found that the amplitude and the AUC of LLRs was significantly higher in PD patients than HS, for each velocity we considered. The NC was significantly higher in PD patients than HS from 200°/sec. Also, the higher the velocity, the higher the amplitude and the AUC of LLRs and the NC in PD patients. We found that all the features analyzed for the SLRs, the latency and the duration of the LLRs, the VC and the EC was comparable between HS and PD patients at all the angular velocities.

Discussion: For the first time, we demonstrated the velocity-dependent feature of the objective rigidity in PD, as shown by higher values of both NC and LLRs. We also found a positive correlation between LLRs and NC, suggesting that the overall objective rigidity in PD would share at least some neural loops underlying the LLRs.

References:

[1] Delwaide PJ. Parkinsonian rigidity. *Funct Neurol*. 2001;16(2):147-156.
[2] Rothwell JC, Obeso JA, Traub MM, Marsden CD. The behaviour of the long-latency stretch reflex in patients with Parkinson's disease. *J Neurol Neurosurg Psychiatry*. 1983;46(1):35-44. doi:10.1136/jnnp.46.1.35.
[3] Teräväinen H, Tsui JKC, Mak E, Calne DB. Optimal Indices for Testing Parkinsonian Rigidity. *Can j neurol sci*. 1989;16(2):180-183. doi:10.1017/S0317167100028857.
[4] Xia R, Muthumani A, Mao ZH, Powell DW. Quantification of neural reflex and muscular intrinsic contributions to parkinsonian rigidity. *Exp Brain Res*. 2016;234(12):3587-3595. doi:10.1007/s00221-016-4755-9.