

**A study on the correlations between acoustic speech variables and bradykinesia in advanced Parkinson's disease**

*Francesco Cavallieri*<sup>1</sup>, G. Di Rauso<sup>2,3</sup>, A. Gessani<sup>3</sup>, C. Budriesi<sup>2,3</sup>, V. Fioravanti<sup>1</sup>, S. Contardi<sup>4</sup>, E. Menozzi<sup>5</sup>, S. Pinto<sup>6</sup>, E. Moro<sup>7</sup>, F. Antonelli<sup>3</sup>, F. Valzania<sup>1</sup>

<sup>1</sup> Neurology Unit, Neuromotor & Rehabilitation Department, Azienda USL-IRCCS di Reggio Emilia, Reggio Emilia, Italy

<sup>2</sup> Department of Biomedical, Metabolic and Neural Sciences, University of Modena and Reggio Emilia, Modena, Italy

<sup>3</sup> Neurology, Neuroscience Head Neck Department, Azienda Ospedaliero-Universitaria di Modena, Modena, Italy

<sup>4</sup> IRCCS Istituto delle Scienze Neurologiche di Bologna, Neurologia e Rete Stroke Metropolitana, Ospedale Maggiore, Bologna, Italy

<sup>5</sup> Department of Clinical and Movement Neurosciences, UCL Queen Square Institute of Neurology, London, UK

<sup>6</sup> Aix Marseille Univ, CNRS, LPL, Aix-en-Provence, France

<sup>7</sup> Grenoble Alpes University, Division of Neurology, Centre Hospitalier Universitaire de Grenoble, Grenoble Institute of Neuroscience, Grenoble, France

*Introduction:* Very few studies have assessed the presence of possible correlation between speech variables and limb bradykinesia in patients with Parkinson's disease (PD).

*Objective:* The objective of this study was to find the presence of correlation between different speech variables and upper extremity bradykinesia in different medication conditions in a cohort of advanced PD patients.

*Methods:* Retrospective data from advanced PD patients before and after an acute levodopa challenge were collected. Each patient was assessed through a perceptual-acoustic analysis of speech which included several quantitative parameters (i.e. maximum phonation time [MPT]; Shimmer Local dB); a neurological evaluation with the administration of the Unified Parkinson's Disease Rating Scale (UPDRS) (total scores, subscores and items) and a timed test (tapping test for 20 seconds) to quantify upper extremity bradykinesia. Pearson's correlation coefficient was applied to find correlation between the different speech variables and tapping rate.

*Results:* 53 PD patients (males: 34; disease duration: 10.66 [sd 4.37] years; age at PD onset: 49.81 years [sd 6.12]) were included. Levodopa intake significantly increased the MPT of sustained phonation ( $p < 0.01$ ) while significantly reduced speech rate ( $p = 0.05$ ). In the defined-OFF condition, MPT of sustained phonation correlated positively with both bilateral mean ( $p = 0.044$ ,  $r$ -value: .299) and left ( $p = 0.033$ ,  $r$ -value: .314) tapping.

In the defined-ON condition patients with a longer MPT performed well the tapping test with both arms.

*Conclusions:* This study confirms the presence of correlations between speech acoustic variables and upper extremity bradykinesia in a cohort of advanced PD patients. This may be due to common pathophysiological mechanisms.

