POSTER Session:
Malattie Degenerative
ID n. 294

Azienda Ospedaliero Universitaria Pisana
OSPEDALE DI RILIEVO NAZIONALE E DI ALTA SPECIALIZZAZIONE

Olfactory functions in progression of the Parkinson's disease

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Introduction: In Parkinson's disease (PD) olfactory function impairment is an early dramatic event that is anticipatory of the progression of the disease. The purpose of our study is to monitor the olfactory function impairment in different patient's progression of PD, by using psychophysical tests.

Materials and Methods: PD patients (N = 11, age range 67-80 yrs) were divided in early stages Parkinson's Disease (EPD) and advanced (APD). We used a not invasive technique to evaluate the olfactory function characteristics: threshold, discrimination, identification, associative and short-term memory through the use of single odorants of natural extraction. The olfactory threshold (OT) is the Cain test adapted [1]. Olfactory discrimination (OD), the subject is required to choose between three vials the only one with odor. In the olfactory identification (OI) a multiple choice test is presented with correct, confounding and two wrong answers, one. The associative memory (OAM) is evaluated by the number of correct free answer to a given stimuli. In short-term memory (OSTM) is required to memorized a stimulus and find it between three vials containing two confounding stimuli

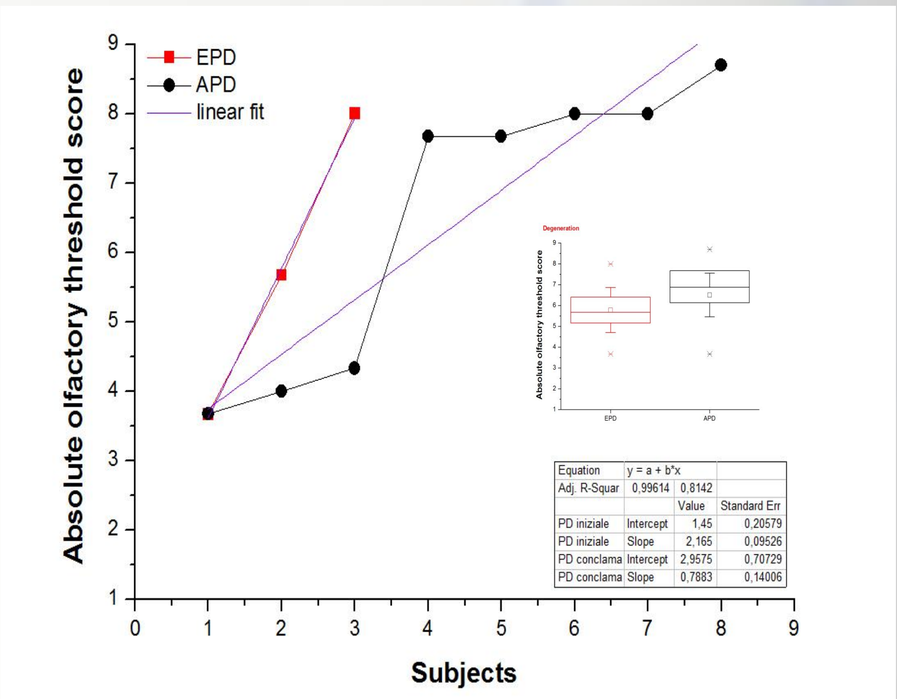

Fig.1. Absolute olfactory threshold in early (red) and advances (black) PD patients (Cain test modified): slope steepness suggest rapid processes occur in EPD, while not in APD. Inset box and whiskers chart.

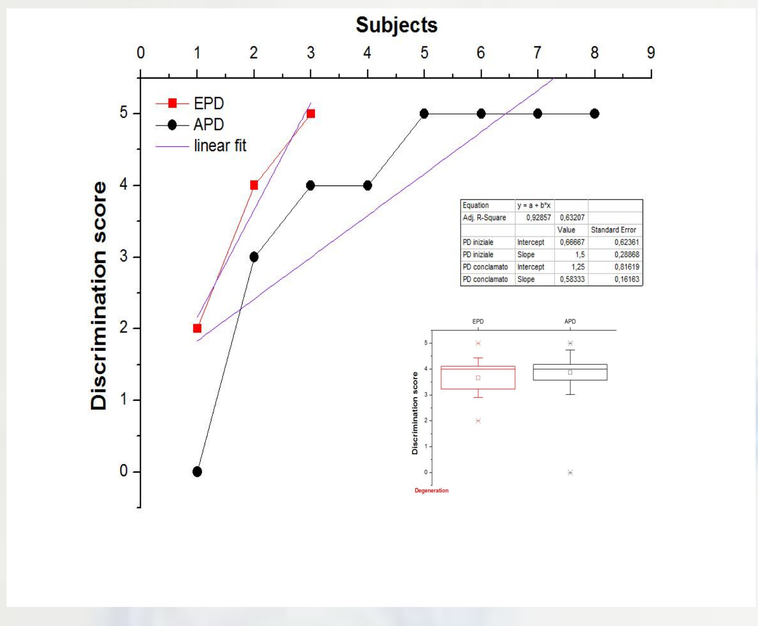

Fig.2. Olfactory discrimination in early (red) and advances (black) PD patients: slope steepness suggest rapid processes occur in EPD, while not in APD. Inset box and whiskers chart.

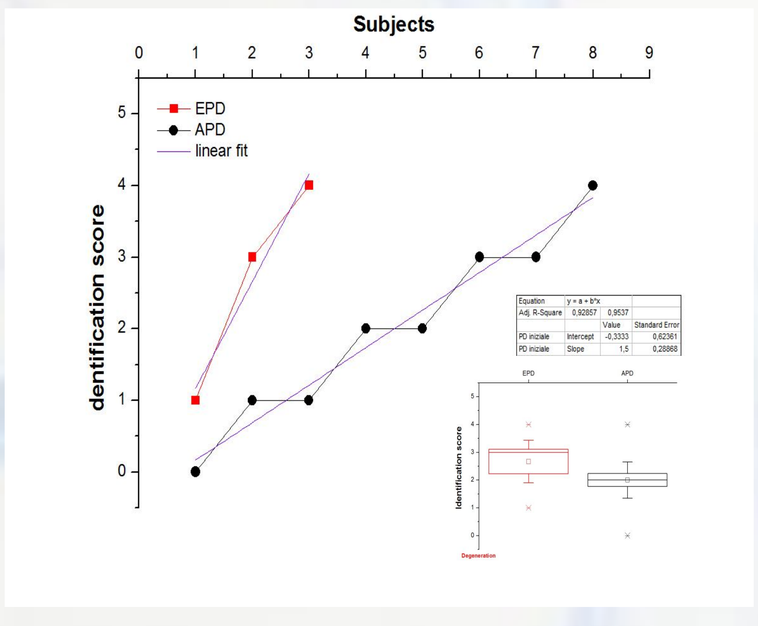

Fig.3. Olfactory identification in early (red) and advances (black) PD patients: slope steepness suggest rapid processes occur in EPD, while not in APD. Inset box and whiskers chart.

Results: In PD olfactory impairment occurs rapidly and dramatically. OT linear fit is $R^2 = 0.996$ in EPD (intercept is 1.45 0.2 SD and slope is 2.17 0.1 SD), APD is $R^2 = 0.814$ (intercept is 2.96 0.7 SD and slope is 0.79 0.1 SD), (Fig. 1). OD linear fit is $R^2 = 0.929$ in EPD (intercept is 0.67 0.6 SD and slope is 1.5 0.3 SD) while in APD is $R^2 = 0.623$ (intercept is 1.25 0.8 SD and slope is 0.58 0.2 SD), (Fig. 2). OI linear fit is $R^2 = 0.929$ in EPD (intercept is -0.33 0.6 SD and slope is 1.5 0.3 SD) while in APD is $R^2 = 0.954$ (intercept is -0.36 0.2 SD and slope is 0.52 0.04 SD), (Fig. 3). In OAM linear fit is $R^2 = 1$ in EPD (intercept is -1 and slope is 1) while in APD is $R^2 = 0.915$ (intercept is -0.93 0.3 SD and slope is 0.51 0.06 SD), (Fig. 4). In OSTM linear fit is $R^2 = 0.5$ in EPD (intercept is 1.3 1.3 SD and slope is 1 0.6 SD) while in APD is $R^2 = 0.67$ (intercept is 0.65 0.5 SD and slope is 0.36 0.09 SD), (Fig. 5).

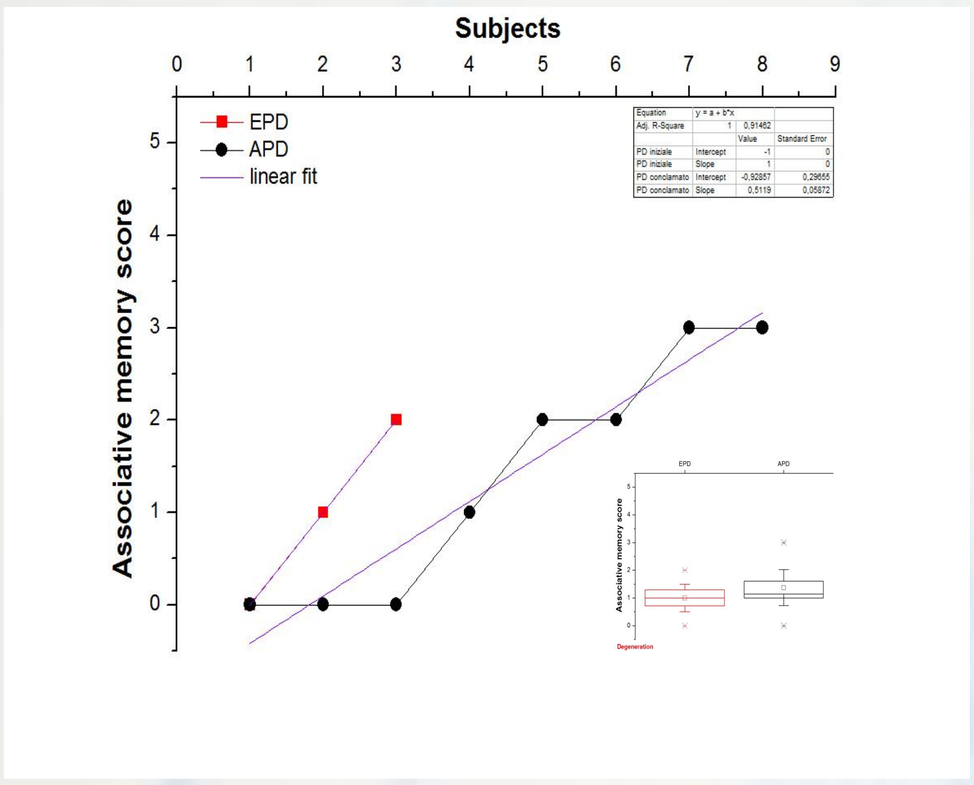

Fig.4. Olfactory associative memory in early (red) and advances (black) PD patients: slope steepness suggest rapid processes occur in EPD, while not in APD. Inset box and whiskers chart.

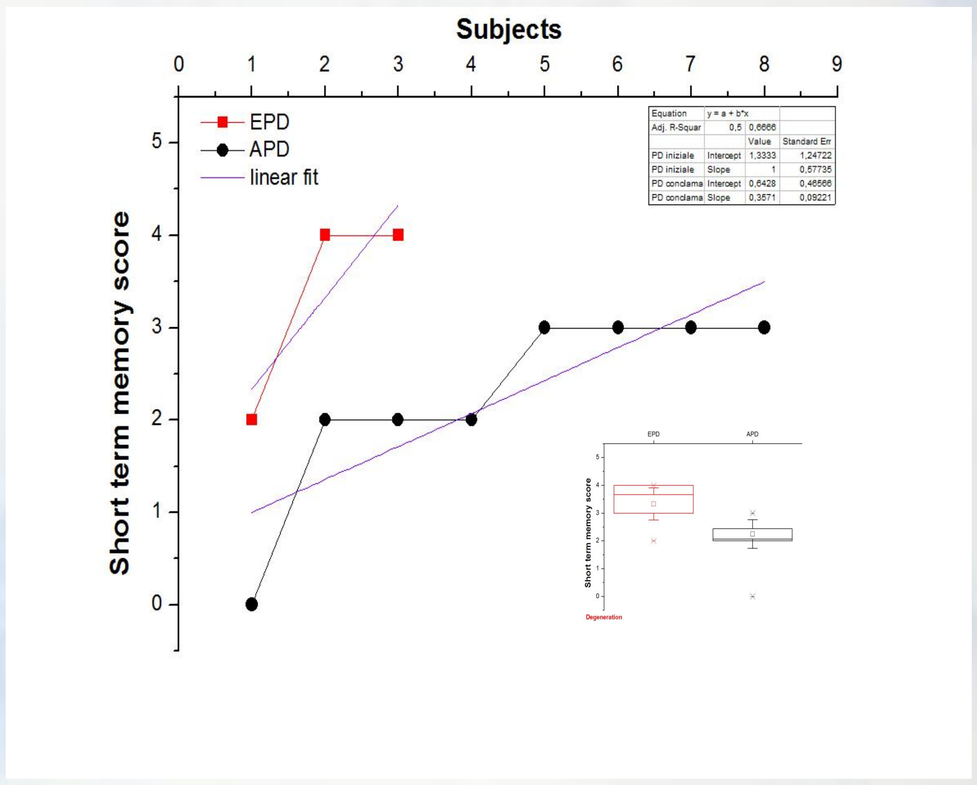

Fig.5. Olfactory short term memory in early (red) and advances (black) PD patients: slope steepness suggest rapid processes occur in EPD, while not in APD. Inset box and whiskers chart.

Discussion: A growing body of literature strongly suggests the neurophysiological role of olfaction in PD. The complete olfactory function between EPD and APD we have here explored. Our preliminary results suggest faster linear and dramatic olfactory impairments at the initial phases of disease.

XLVII Congresso Società Italiana di Neurologia,
Venezia, 22-25 Ottobre 2016

References:
1 - Mazzatenta A et al (2016) Oncotarget 7(15);19193-19200

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