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Spectroscopic molecular characterization of saliva for the diagnosis and monitoring of Parkinson's disease

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Introduction: Despite the plethora of proposed biomarkers for Parkinson's disease (PD), there are no specific molecules or signals able to early and uniquely identify the pathology onset, progression and stratification in easily accessible liquid biopsies. Saliva is a complex biofluid that contains multiple components shared with blood and cerebrospinal fluid, including PD related molecules. However, the limited analyte concentrations require high throughput and sensitive methods to use saliva in diagnostics. Raman spectroscopy (RS) is a label free vibrational technique able to detect the concomitant presence and concentration of different molecules, with demonstrated translatability to clinics [1].

Objective: The main aim of the present study was the identification of the molecular fingerprint of saliva of people with PD by RS, to be used as biomarker of disease onset and progression. Besides, our work was aimed at the identification of specific spectral assignment taking advantage of computational chemistry.

Methods: Saliva was collected from 25 people with PD and control subjects (33 healthy; 10 Alzheimer's patients). RS acquisition was performed on dry drops of saliva lied on aluminium slides. Multivariate statistical analysis was performed to compare data from the recruited subjects. Computational chemistry was used to investigate potential molecules involved in the observed PD associated spectral variations.

Results: The proposed procedure allows the collection of detailed and repeatable spectra using a fast protocol with minimal sample preparation. The selected groups of patients were discriminated with 89% accuracy and the salivary composition of PD samples was successfully correlated with levodopa equivalent daily doses, Hoehn&Yahr stages and UPDRS III [1]. Moreover, the preliminary computational chemistry results provide hints for the identification of the molecular contribution of alpha-synuclein to the salivary spectra.

Conclusions: The proposed pilot study paves the way to the use of the salivary Raman spectrum in order to assess PD onset and progression, having the potentiality to be transferred to clinics.

References:
[1] Carlomagno C et al., 2021. Front Neurosci; 15: 704963.