Identification of spectroscopic markers of amyotrophic lateral sclerosis

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Abstract:

Amyotrophic Lateral Sclerosis (ALS), a neurodegenerative disorder associated with the aggregation of misfolded proteins, causes the degeneration and death of motor neurons, leading to muscle weakness and atrophy. To date, ALS diagnosis is based on the patient symptoms and signs, along with clinical tests to exclude other mimicking pathologies. In this perspective, the discovery of biomarkers able to discriminate diseased from healthy individuals can have a potential impact in the development of new diagnostic tools, as well as in obtaining new insights on the molecular bases of the disease.

Since recently it has been reported the ocular involvement in ALS, tears have been proposed as potential source of biomarkers.

Fourier transform infrared (FTIR) microspectroscopy, coupled to multivariate analysis, can offer a powerful diagnostic tool that provides in a rapid way a “spectroscopic fingerprint” of the sample under investigation, representing a snapshot of the composition and structure of its main biomolecules. Samples can be not only an isolated biomolecule, but also intact cells, tissues, and biofluids.

Here, we applied this label-free and non-invasive vibrational approach to analyze tears from ALS positive patients and healthy controls (HCs). The spectroscopic characterization was supported by multivariate analysis that not only made it possible to achieve a discrimination between the two sample classes with a very high sensitivity, but also to identify the most significant spectral changes responsible for the discrimination. Our preliminary results highlighted firstly significant differences in the protein content and structures in tears from ALS positive and HCs. Moreover, the spectroscopic analyses identified lipids as potential ALS bio-indicator, in agreement with the reported crucial role of dyslipidemia as hallmark of the pathology.

To evaluate the specificity of the spectroscopic markers, we will analyze tears from patients affected by different diseases sharing common features with ALS.

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