Disentangling Blink Reflexes in Multiple Sclerosis with machine learning techniques

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Brainstem dysfunctions are common in Multiple Sclerosis (MS) and are a critical predictive factor for future disability. Brainstem functionality can be explored with blink reflexes, i.e., subcortical responses consisting in a blink following peripheral stimulation. We explored the features of Trigeminal Blink Reflex (TBR) and Hand Blink Reflex (HBR) in 20 people with MS (PwMS) and 20 Healthy Controls (HC). In addition, to investigate microstructural integrity of the cortico-brainstem pathway in association with reflexes features, participants underwent Diffusion Tensor Imaging (DTI). From DTI, we calculated mean Fractional Anisotropy (FA), an indicator of white matter (WM) integrity, in the Anterior Corona Radiata (ACR), a bundle of ascending and descending fibers connecting the brainstem to the cerebral cortex. Besides, we explored neurophysiological data with Machine Learning (ML) techniques, training two classifiers with TBR and HBR features for a binary classification task between PwMS and HC. We found alterations in TBR and HBR in the PwMS group, suggesting that they involve separate brainstem circuits, and possibly provide different information on tissue damage localization. Interestingly, PwMS did not show the physiological HBR modulation related to the hand proximity to the body, indicating a possible alteration in the near-space representation. White matter integrity in ACR was lower in PwMS than HC, and was significantly different between the left and right ACR in PwMS. This hemispheric imbalance was higher in the PwMS showing less HBR modulation, indicating that PwMS with more hemispheric balance showed an evoked response similar to HC, even with a reduced WM integrity. The adopted ML techniques showed good accuracy in identifying PwMS, and we are currently expanding the sample to describe specific alterations of HBR in PwMS with ML, allowing the extraction of the most relevant features of the reflex, with the goal to identify biomarkers of pathology.