Journal of Affective Disorders
Available online 15 March 2022
In Press, Journal Pre-proof

Research paper

Retinal electroretinogram features can detect depression state and treatment response in adults: A machine learning approach

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https://doi.org/10.1016/j.jad.2022.03.025

Highlights

- Retinal function is relevant to study brain function in major depressive disorder.

- Retinal dysfunctions were observed with electroretinogram in major depressive disorder.
- Signal processing and machine learning tools were applied on electroretinogram data.
- Signal processing and machine learning tools can help clinical decision.

Abstract

Background

Major depressive disorder (MDD) is a major public health problem. The retina is a relevant site to indirectly study brain functioning. Alterations in retinal processing were demonstrated in MDD with the pattern electroretinogram (PERG). Here, the relevance of signal processing and machine learning tools applied on PERG was studied.

Methods

PERG – whose stimulation is reversible checkerboards – was performed according to the International Society for Clinical Electrophysiology of Vision (ISCEV) standards in 24 MDD patients and 29 controls at the inclusion. PERG was recorded every 4 weeks for 3 months in patients. Amplitude and implicit time of P50 and N95 were evaluated. Then, time/frequency features were extracted from the PERG time series based on wavelet analysis. A statistical model has been learned in this feature space and a metric aiming at quantifying the state of the MDD patient has been derived, based on minimum covariance determinant (MCD) mahalanobis distance.

Results

MDD patients showed significant increase in P50 and N95 implicit time ($p = 0{,}006$ and $p = 0{,}0004$, respectively, Mann–Whitney U test) at the inclusion. The proposed metric extracted from the raw PERG provided discrimination between patients and controls at the inclusion

(p=0,0001). At the end of the follow-up at week 12, the difference between the metrics extracted on controls and patients was not significant (p=0,07), reflecting the efficacy of the treatment.

Conclusions

Signal processing and machine learning tools applied on PERG could help clinical decision in the diagnosis and the follow-up of MDD in measuring treatment response.

Keywords

Major depressive disorder; Retina; Electroretinogram; Wavelet analysis; Machine learning; Help for clinical decision

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The PERG data were analyzed using an ophthalmic monitor (**Metrovision**, Pérenchies, France). Two main components are usually described on a typical PERG trace