Poster

Can We Predict Depression From the Asymmetry of Electrodermal Activity?

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Abstract

Background: Historically, diagnosing and tracking depressive symptoms has been accomplished by assessing subjective diagnostic criteria, either from the Diagnostic and Statistical Manual of Mental Disorders (DSM) or from standardized rating scales. Though useful for semantic and billing purposes, this approach has limited utility for (1) determining subtypes of depression, (2) capturing variations over relatively short time periods (eg, over the course of a day), and (3) predicting the course of the illness. Despite recent research efforts, no clinically useful, non-invasive, inexpensive biomarkers for the diagnosis and prognosis of depression have been identified.

Objective: There is a critical need to identify and discover objective biomarkers for the diagnosis, prognosis, and treatment of depression. Brain imaging and recent findings have led us to hypothesize that depression, especially of the anxious type, might lead to larger right amygdala activation than left in most right-handers and that this would map to larger electrodermal activity (EDA) on the right than on the left.

Methods: We monitored EDA on both inner wrists of 9 patients diagnosed with depressive episode without psychotic features, aged 18-80, undergoing transcranial magnetic stimulation (TMS) at the Massachusetts General Hospital. Three patients attended 36 daily TMS sessions and six patients attended 72 sessions lasting 25-45 minutes each. In addition, a clinician, blinded to the EDA, assessed severity of depression every 10 TMS sessions using the following psychometric scales: Hamilton Depression Rating Scale, Quick Inventory of Depressive Symptoms (QIDS), and Patient Health Questionnaire. We obtained an objective measure of laterality by (after noise filtering) calculating the average EDA on each wrist for every session and subtracting the left from the right hand mean value (EDAR-L). We used a linear mixed-effects model with random intercepts and slopes to assess the relationship between the EDAR-L and the depression measures (as assessed by the blinded clinician), delayed by 3 days using the following model: $QIDSi=\beta 0i+\beta 1i\times EDAR–Li+\varepsilon i$, where EDAR-Li=mean difference between EDA signal on the right and left wrist; QIDSi=QIDS score for i-th person delayed by 3 days; 0i=i-th person intercept; $\beta 0i=\beta 0+\mu 0i$ and $\mu 0i\sim N(0,\sigma 02)$; $\beta 1i$=i-th person slope, $\beta 1i=\beta 1+\mu 1i$, and $\mu 1i\sim N(0,\sigma 12)$; and εi=i-th person error, and $\varepsilon i\sim N(0,\sigma 2)$.

Results: We tested the model by varying the delay between –11 and 11 days. The corresponding slopes were always positive ($0.2<\beta 1<5.8$) and usually not statistically significant ($P>.1$). However, a delay of 3 days was significant with a value for intercept ($\beta 0$) 13.9 and for slope ($\beta 1$) 2 ($P=.03$). This indicates that QIDS score follows the pattern of the EDA asymmetry with a delay of 3 days—when the EDA on the right hand becomes more (less) dominant, the depression worsens (improves).

Conclusions: Initial findings show that asymmetry of the EDA signal from wrists measured during TMS sessions may indicate depression. These data have the potential to provide objective biomarkers to advance the understanding and treatment of depression. The results, if confirmed in a larger population, may potentially contribute to early diagnosis and monitoring of depression.

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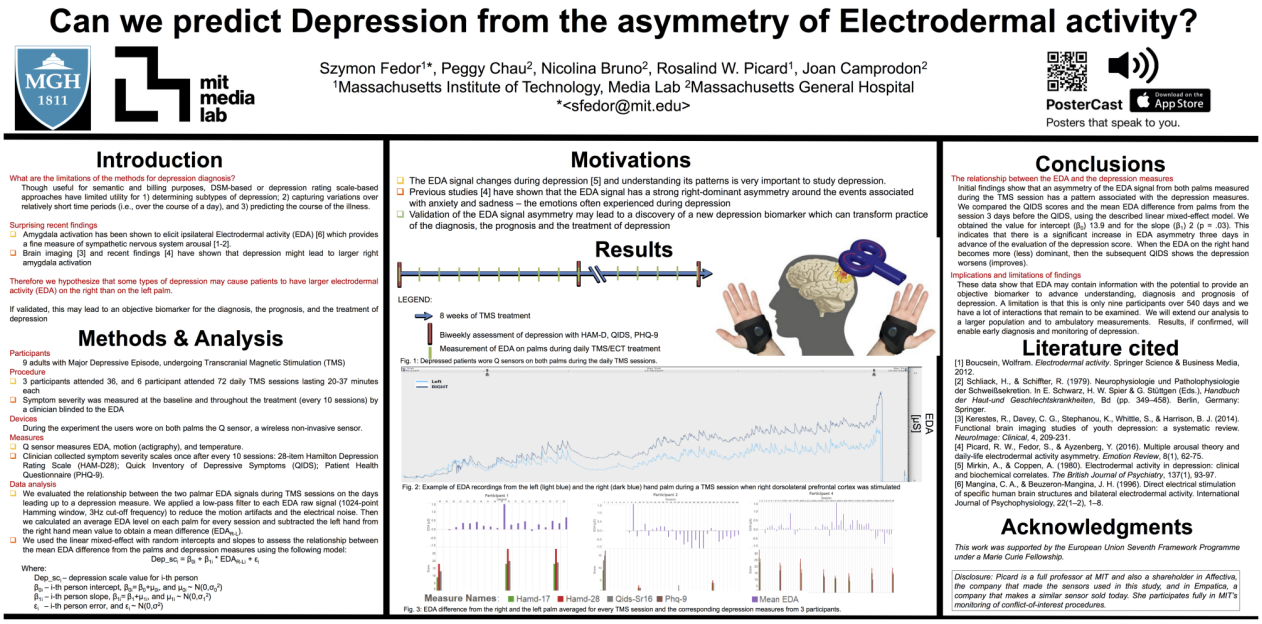
KEYWORDS

depression; biomarker; electrodermal activity

This poster was presented at the Connected Health Symposium 2016, October 20-21, Boston, MA, United States. The poster is displayed as an image in Figure 1 and as a PDF in Multimedia Appendix 1.

Figure 1. Poster.



Multimedia Appendix 1

Poster.

[PDF File (Adobe PDF File), 861KB-Multimedia Appendix 1]

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