General error monitoring system dysfunction in Obsessive Compulsive Disorder (OCD) patients

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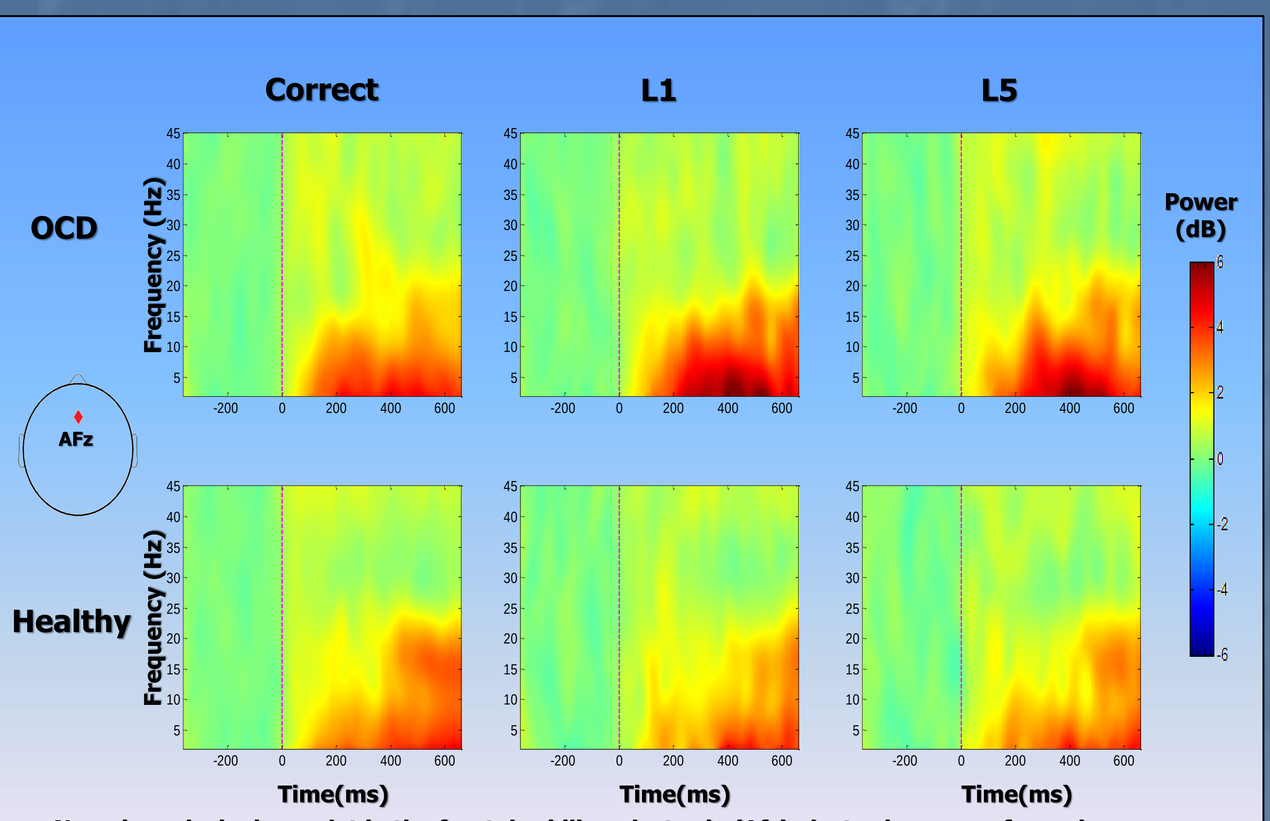
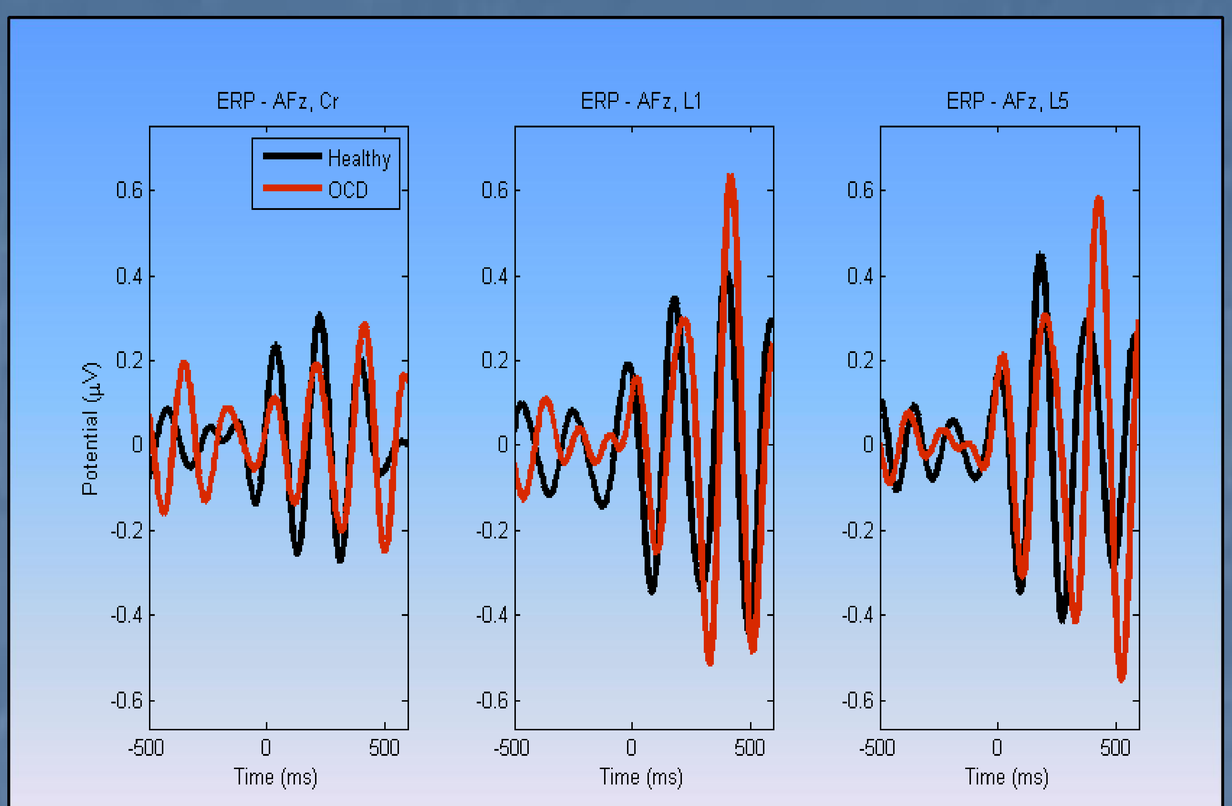
Figure 2: Enhanced activity in OCD patients after incorrect solutions presentation



Non phase-locked wavelet in the frontal-midline electrode (Afz) electrode was performed on segments temporally centered around solution presentation. Compared to healthy participants, OCD patients demonstrated power enhancement after incorrect solution conditions were presented (L1 and L5) compared to correct solutions.

Figure 3: Theta frequency activity after incorrect solutions presentation



Grand Average ERP to theta band (4-8 Hz) in the Afz electrode. Segment was locked to solution presentation. Compared to healthy participants, OCD patients demonstrate enhanced Theta activity once incorrect solution conditions were presented.

Introduction: Enhanced Error Related Negativity (ERN) signal after making mistakes is more frequent in OCD patients compared to healthy participants and was found to be generated by theta band [1]. Nevertheless, it is not clear whether this hyperactive ERN signal reflects a hyperactive monitoring system that is over-sensitive to punishment cues or a dysfunction of a more general and less affective monitoring system. The latter manner would imply a system which continuously seeks out erroneous information in the inner or outer environment, regardless of a mistake being made. Indeed, normal participants have shown enhanced theta activity merely by identifying erroneous content [2].

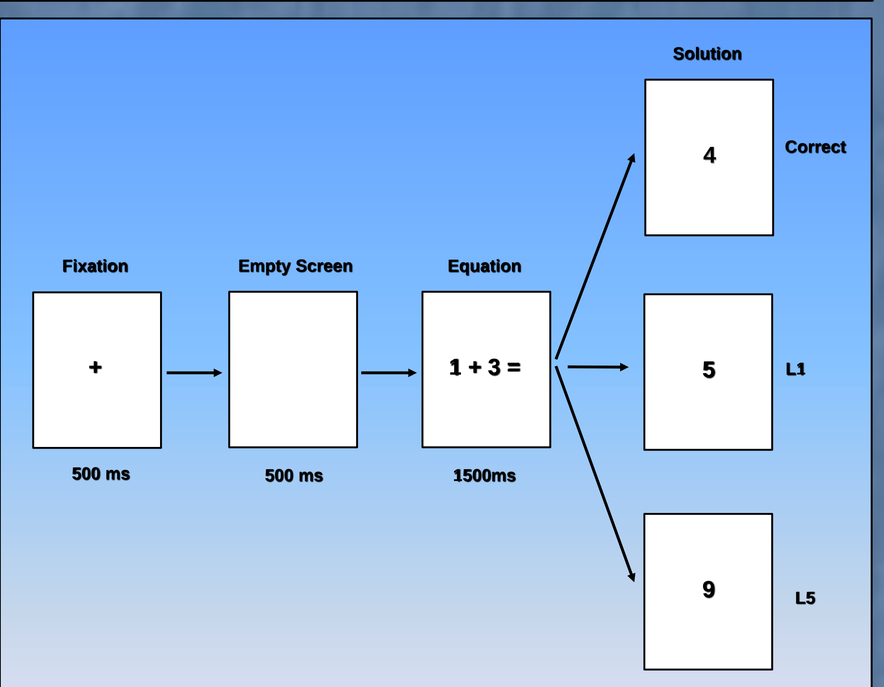
A. To test the hypothesis of a general hyperactive monitoring system we tested whether OCD patients show enhanced theta activity after identifying erroneous content as compared to controls.

B. As the ERN enhancement is correlated with OC symptom severity, we hypothesized that reduction of the hyper theta activity in OCD patients, via Deep Trans Cranial Magnetic Stimulation (dTMS), will correlate with a decrease in symptom severity.

Methods :

9 OCD patients and 9 healthy controls were requested to indicate whether a solution to a simple equation is either correct or incorrect (task adapted from Tzur & Berger, 2007; see figure 1). EEG was recorded with a 32 electrodes cap in 256 Hz sampling rate and was average referenced. Eye blinks and movements were eliminated using an exemplar based PCA ocular correction method. Data was temporally segmented around the presentation of the solution and then transformed to frequency domain using a non phased locked wavelet (see figure 2). In addition, data was filtered to Theta band (4-8 Hz) and the segment was locked to solution presentation (see figure 3). The OCD group went through five weeks of double-blind dTMS treatment (active vs. sham) and was measured weekly by YBOCS (see figure s 4, 5)

Figure 1: Equations task (Tzur & Berger, 2007)

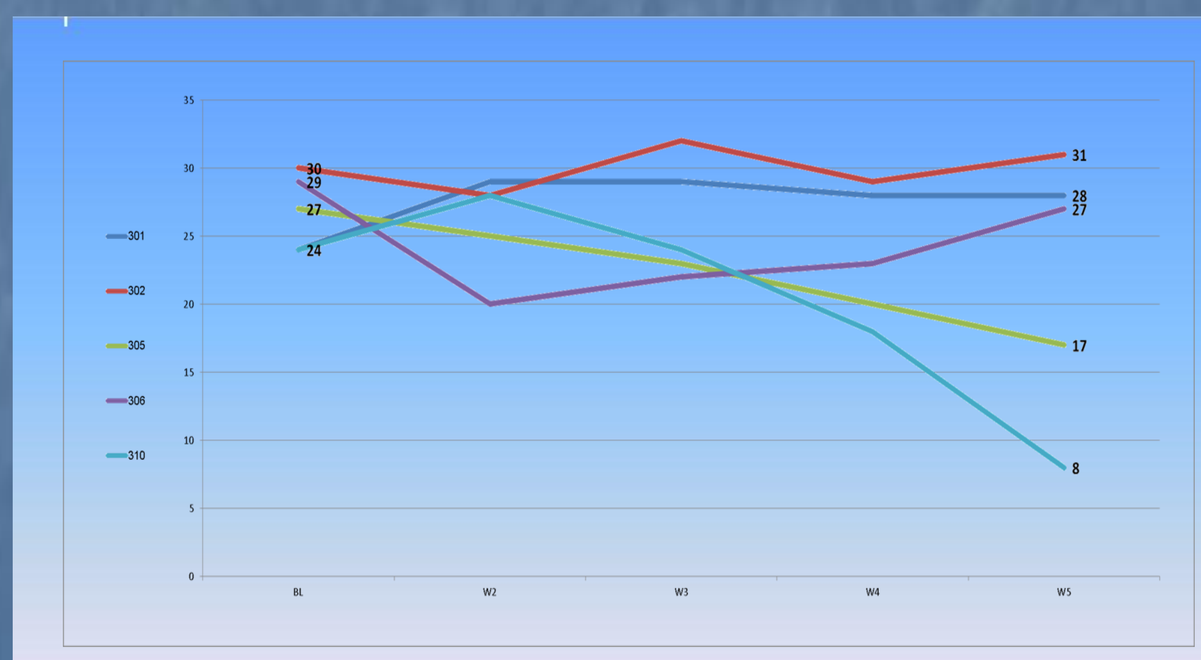


Participant were required to indicate whether a solution to a simple equation is correct or wrong. Incorrect solutions deviated from correct answer by lags of 1-2 (L1) or 4-5 (L5).

Figure 4: YBOCS scores of sham treatment group

Weekly YBOCS scores of sham deep TMS group. No remission criteria (reduction of 35% from baseline) was obtain in any of the patients

Figure 5: YBOCS scores of real treatment group



Weekly YBOCS scores of real deep TMS group. Remission criteria (reduction of 35% from baseline) was obtained in 2 out of 5 patients.

Conclusions

Over-monitoring condition is expressed in OCD patients not only when an error is committed (ERN), but also upon observing an error. Moreover, a reduction of this hyper activity (via dTMS) was associated with reducing OC symptom severity (as measured in the YBOCS scores). These interim findings may imply a cognitive endophenotype basis for the bias attributed to OCD patients.

bibliography
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