Sensory event related potentials slowing in migraine
Independent components GO/NOGO paradigm: a search for endophenotypes in migraine

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References [1] Bjork, van established in SIGNIFICANT
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Results & Discussion: THE ANALYSIS OF THE ERROR RATES AND RT PERFORMANCE DID NOT SHOW SIGNIFICANT DIFFERENCES BETWEEN THE GROUPS: THE MEANS ARE 484 (SD=102), 480 (SD=76) AND AND 502 (SD=134) FOR MIGRANEURS WITH AURA, WITHOUT AURA AND CONTROLS RESPECTIVELY. IN ADDITION, THAT:

1. Increase of P400 conflict monitoring component. (Fig. 3, IC-4) This NOGO-related IC identified in the present study has a frontal distribution; it peaks at 400 ms, corresponding to the mean latency of response to GO cues. The P400 component was reproducible in the anterior cingulate cortex. Taking into account the involvement of the anterior cingulate cortex in a hypothetical conflict monitoring operation [13, 14, 15], we associate the P400 frontal-central IC selected in the present study with conflict monitoring. Indeed, in the two-stimulus paradigm used in the present study the subject develops a behavioral model: to press a button in response to a “plant” response after a prior “animal” (NOGO monitoring), this stimulus does not fit the behavioral model (a conflict) and this conflict seems to activate neurons in the anterior cingulate cortex that monitor this conflict situation.

2. Dec. of P300 motor suppression component. (Fig 3, IC-3) This component has a central distribution with a peak latency of 340 ms, which is 60 ms shorter than the mean latency of THE response, and is completely absent in response to GO cues. According to sLORETA [6] this component is correlated with the premotor cortex (Brodman area 6). This component appears to correspond to subcortically recorded potentials found over pre-supplementary motor cortex in GO/NOGO tasks in epileptic patients in response to NOGO stimuli. It has been demonstrated previously that the fact that direct stimulation of the pre-supplementary motor cortex can inhibit ongoing, habitual motor actions [11]. A recent meta-analysis of fMRI studies in GO/NOGO tasks demonstrates that Brodmann area 8 is one of the most commonly activated areas of the cortex [12] thus supporting the involvement of this area in response inhibition and response inhibition. Thus we associate the centrally distributed P340 NOGO related IC separated in the present study with inhibition of a prepared motor action in response to NOGO cues.

Conclusions: Two main conclusions can be drawn from ICA analysis of ERPs. First, it appears, that the anterior cingulate cortex in migraine patients is hyper-active in comparison to CONTROLS. Second, it appears that the premotor area in the migraine patients is hypervactive. More patients data have to be collected to further support these results and test whether ERPs analysis can be used for migraine diagnostics.

Objective: It is not to what extent migraine affects cognitive performance and its underlying neuronal substrate. Here we studied this question by combining a go-no-go task with quantitative electromyography (qEEG) and independent component analysis (ICA) of event related potentials (ERP) to establish a quantitative endophenotype of migraine.

Background: Migraine is a widespread disorder that affects over 6% of men and 15% of women. This has shown great promise in other areas such as ADHD [3]. THIS ALSO RAISES THE POSSIBILITY THAT IT ALSO CAN BE USED TO DISAMBIGUATE THE SYMPTOMATOLOGY OF MIGRAINE.

Methods: Twenty female patients with a mean age of 40 years old, diagnosed with chronic episodic migraine with or without aura [8] (10 with aura, 10 without aura) had EEG recorded from 19 electrodes of the International 10-20 System during a 10 min recording session. EEG was recorded using a high pass filter at 0.1 Hz, a frequency range in the following conditions: eyes closed for 5 minutes, eyes open for 5 minutes, and a modified version of a GO/NOGO task. Visual Continuous Performance Task (VCP) (Fig 1) for 20 minutes.

EEG power (Fig 2) and EEG band power asymmetry (Not shown), as described by Bjork and Sand [8] in all conditions and Independent component related potentials (ERPs) (Fig 3) were compared with the corresponding age matched parameters from the Human Brain Institute (HBI) [16] normative database (Controls N=172, females age 18 to 45 years).

Figure 1. Visual Continuous Performance Task (VCP). The VCP is a ‘Go-NoGo’ task. There are three types of visual stimuli, presented in four different pairs of 100 trials each: The ‘Animal-Animal’ is the ‘GO’ trial where the subject must press a button as quickly as possible after the second animal stimulus; the ‘Animal-Plant’ is the ‘NO-GO’ trial where they must refrain from pushing. ‘Plant-Plant’ is a discontinuous trial, and ‘Plant-Human’ presented COMBINED with an artificial sound of five pure tones of 500, 1000, 1500, 2000 or 2500 Hz during the novel trial. The trials are presented in random order with equal probability. The duration of stimulus is 100 ms, Inter-stimulus interval within a pair is 1100 ms. Interval between trials is 3100 ms. The task lasts 20 minutes. [3] [4]

Figure 2. Utermer in EEG spectra of migraine vs controls, top: the EEG Spectral of each Migraine group is subtracted from the control group to generate a “differences wave”. The data was filtered with the red arrow shows a statistically significant increase p<0.05 or p<0.01 in the low Beta frequency band (13-20 Hz) over the sensory motor strip (C3, Cz, C4).

Bottom: The map of the power difference of the statistical significant frequencies BETWEEN MIGRAINE PATIENTS AND CONTROLS SHOWING a hyperactivation of this part of the cortex in migraine patients.

GO trial
NOGO trial

Figure 3: Independent Component Analysis of ERPs: The top row plots SHOW the ERPs, Controls (Blue), Migraine with Aura (Green) and Migraine without Aura (Red). The vertical “y” axis to the dotted vertical line represents the 100 ms when the second stimulus of the “Animal-Plant” trial is displayed. It can be seen in the 3rd “Motor Suppression” (IC-3) and 4th “Conflict Monitoring” (IC-4) components THA the blue “controls” line is significantly different from both Migraine groups.

The central row is the difference wave, where each of the Migraine groups has been subtracted from the control group. The small red and green bars beneath the 3rd, 4th and 5th component, indicate a statistical significance difference of either peak for the smallest bars, p<0.01, for the medium bars or p<0.001 for the largest bar above the line is positive and below is negative. The bottom row shows 3-D sLORETA [6] images of the brain generators of the independent components of the ERPs [6] [2]