Comparison of ECoG and ECS language mapping with high-density electrodes

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PATIENTS suffering from intractable epilepsy are candidates for surgical treatment. In order to make precise diagnosis for epileptogenic foci and eloquent brain regions, it is indispensable to make functional mapping using electroencephalography (EEG), electrocorticography (ECoG) and functional magnetic resonance imaging (fMRI), electrocortical stimulation (ECS), respectively. Since ECoG detects electric currents directly from the brain surface, it is expected to be the most reliable way to identify normal and epileptogenic brain activity by focusing on spatial and temporal changes of gamma-band oscillations [1]. In this work we used an innovative system for real-time functional mapping based on task-related gamma-band oscillations (cortiQ, g.tec, Austria) related to the work in [2]. The system identifies large cortex areas within minutes and brings the great advantage that the patient can perform tasks voluntarily, instead of feeling externally forced behavior caused by ECS.

The study included ECS and cortiQ mapping with an epileptic patient having 236 subdural electrodes that underwent neuro-monitoring. The left frontal-, left temporal- and left parietal/occipital lobe were covered by high-density grids with inter-electrode distance of 5 mm and conductive area of 1.5 mm. Also the montage consisted of 56 standard ECoG electrodes covering right temporal lobe, as well as left and right temporal base. A picture naming task was performed to identify the language areas with cortiQ and ECS, respectively. The cortiQ mapping consistently showed activation of Brodmann area 44 and 45 in 2 independent runs (Figure 1, left). After the ECS mapping (Figure 1, right) a comparison using next-neighbor approach led to a sensitivity of 77.80 % and a specificity of 88.85 %. Only the significant electrodes ($p<0.001$) of the cortiQ mapping and the electrodes causing aphasia in ECS (red and orange) were interpreted as active channels for comparison.

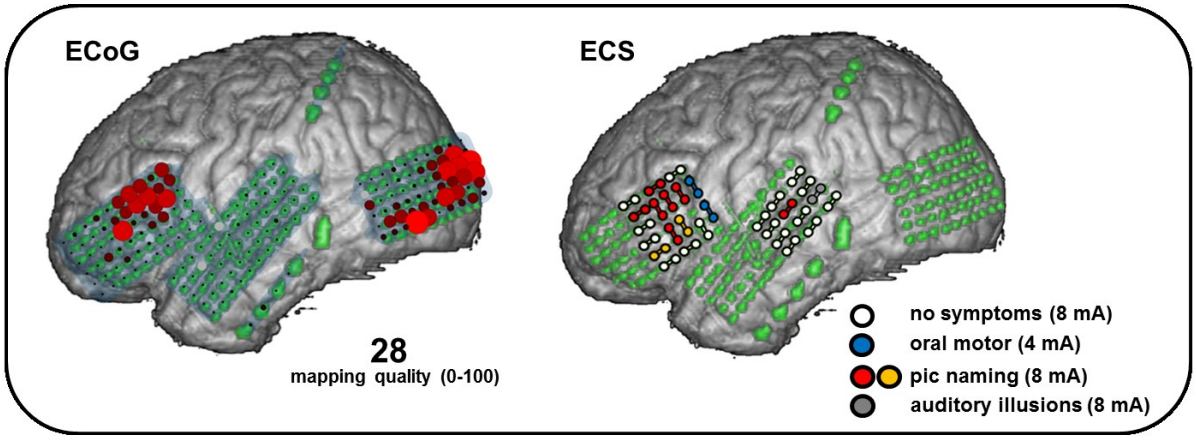

Figure 1: Comparison of cortiQ (left) and ECS mapping (right). The mapping quality shows how good activation can be discriminated from resting condition (100 is perfect).

REFERENCES

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