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## Neuroplastic Effects of Electroconvulsive Therapy in the Prefrontal-limbic Network of Drug Resistant Depression: a Whole-brain Longitudinal SMRI Study

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### **Background:**

Electroconvulsive therapy (ECT) is the most effective and fast acting therapy for treatment-resistant depression (TRD). Animal research has consistently pointed to neuroplasticity as a central mechanism of ECT action (1), however evidence in humans remains scarce (2; 3).

### **Method:**

We assessed two independent samples of TRD patients referred for ECT. The Barcelona-sample included 13 subjects treated with bitemporal ECT and 10 healthy volunteers (HV). Four successive 3T structural MRIs were acquired: baseline, 24-48 hours after the 1st ECT session, 24-48 hours after the 9th ECT, and two weeks after ECT course completion. HV were scanned twice five weeks apart. Within the framework of the Barcelona-Sydney Clinical Imaging Collaboration, we also scanned 10 patients treated mainly with right unilateral ECT (Sydney-sample). Whole-brain longitudinal grey matter (GM) changes were measured using intra-subject diffeomorphic registration, within SPM12b.

### **Results:**

In the Barcelona-sample, over the course of treatment bitemporal ECT produced a linear increase of GM volume in the limbic system (involving bilateral hippocampi and amygdalae). Additionally, volumetric increase within the right subgenual cortex was detected from baseline to the 9th ECT session. Such volume changes were not observed in HV. Furthermore, GM volume expansion correlated positively with depressive symptom improvement and neurocognitive performance (memory and executive function). Hippocampal and amygdalar volume increases were replicated in the Sydney-sample, although limited to the stimulated hemisphere.

### **Conclusions:**

ECT effects described here could be accounted for by the induction of regionally specific structural plasticity. Nevertheless, other mechanisms such as neurovascular changes should not be discarded.