

**Synchronization analysis of epileptic ECoG data:
Inhomogeneous patterns of cortical activity**

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Localization of the epileptogenic zone is an important issue in epileptology. Several diagnostic tools exist (SPECT, MRI, Video-EEG, etc.) aimed to lateralize/localize different areas involved in the generation of the clinical seizures. The objective of the present study is twofold. On the one side to test the aptitude of three well known synchronization measures to differentiate cortical interactions measured by using ECoG data. On the other side, demonstrate highly inhomogeneous cortical electrical activity in temporal lobe epileptic patients. Intraoperative ECoG from 29 patients suffering temporal lobe epilepsy (TLE) were analysed. Recordings were obtained using a grid of 20 electrodes (5x4) covering regions T1, T2 and T3 of the lateral temporal lobe. Linear correlation, mutual information and phase synchronization has been used to quantify intra-cortical synchronization. Surrogate data files have been generated in order to test our results. By distributing locally the interactions between the electrodes, we characterized the spatial patterns of activity. We have found patterns of functional connectivity among the temporal regions. In particular, our calculations show concentrated activity in specific areas in the temporal lobe in most of the patients. From a methodological point of view, linear correlation and phase synchronization shows better performance than mutual information. Our results show significant patterns of inhomogeneous cortical activity in TLE patients. These findings suggest that synchronous interictal activity emerges from specific cortical areas which are highly differentiated from the rest of the temporal cortex, suggesting that synchronization analysis could be used to functionally zoom into the temporal cortex of TLE patients.