

## **Quantitative EEG analyses in epilepsy patients**

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The epileptic cortex is characterized by altered, mainly increased neuronal synchronization, which exists also in interictal state. An EEG-source localization method LORETA (Low Resolution Electromagnetic Tomography) demonstrates the synchronously activated neuronal populations in the 3-dimensional space. For this reason it is an appropriate method to localize the sources of abnormal cortical activity in epilepsy patients. Three, epilepsy-related issues were investigated using LORETA, the main findings are summarized here.

**1.** The first study was designed to analyse EEG-LORETA data of "pure" epileptic predisposition (without epilepsy) in persons who display generalized tonic-clonic seizures precipitated by natural, near-physiological events, but never display spontaneous seizures. Increased degree of neuronal synchronization was assumed based on findings of a few animal experiments. Our findings suggested similar dysfunction in some cortical areas of the patients but the results did not survive statistical analysis. On the other hand, impaired cortical function was found in various cortical regions in patients with pure epileptic predisposition. In the future, targeted studies should be planned to investigate these cortical regions as to understand the mechanisms of seizure susceptibility in the human being.

**2.** In our second study we demonstrated that the enigmatic, diffuse EEG theta activity that was described in untreated partial epilepsy patients is not diffuse at the level of the cortical generators. Instead, it reflects the increased activity of three, anatomically distinct cortical areas (theta areas). Furthermore, our findings suggest (but do not prove) that the localization of the epileptogenic lesion might increase the degree of theta-synchronization bilaterally, particularly in the nearby theta area. Our investigations permit comprehensive evaluation of the role of theta-generators in epileptic condition.

**3.** It is theoretically possible that abnormal oscillations that survive the interictal epileptiform discharge(IED) might contribute to IED-related transient neurological and cognitive deficit symptoms lasting beyond the duration of the IEDs. In this study we were the first to verify the "delayed effect" of IEDs in large neuronal populations, and we developed a method to quantitatively assess and localize IED-related dysfunctions.

Overall, we testified that LORETA is an appropriate method to investigate issues of neurophysiological and clinical importance with high accuracy. Our findings are of methodological and heuristic importance concerning forthcoming investigations in the field of epilepsy.

Key words: EEG, epilepsy, quantitative EEG, source localization, LORETA

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