EEG coherency computed from scalp data and from LORETA model sources

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Introduction: The scalp distribution of EEG potential depends on the location and orientation of the intracerebral sources. Scalp EEG coherences thus cannot reveal non-ambiguous, functional connectivity between brain regions; coherences between intracerebral model sources are needed for non-ambiguous results.

Method: 27-channel EEG was recorded from a healthy volunteer while performing medita-tion and while resting, in 4 independent sessions. N=2323 artifact-free 2-second EEG epochs were analyzed. Intracerebral model sources were computed using LORETA for 2394 brain voxels; each voxel was assigned to the closest scalp electrode position, forming 27 cone-shaped brain regions of interest (ROIs). Coherences were computed between all pairs of scalp EEG electrodes (using various references incl. average reference) and between all pairs of intracerebral LORETA ROIs, for eight frequency bands (in Hz): delta=1.5-6, theta=6.5-8, alpha1=8.5-10, alpha2=10.5-12, beta1=12.5-18, beta2= 18.5-21, beta3= 21.5-30, gamma=35-44. T-statistics compared the coherences between the two conditions.

Results: The coherencies that differed between conditions at p<0.05 were examined further. Between LORETA ROI's, delta, theta, beta1, beta3 and gamma showed more than 10 significant coherence differences. There were massive differences in coherences during two experimental conditions when computed from scalp data and from the intracerebral LORETA model source data (ROI's). As expected, there also were clear differences between results using different scalp references (cf. Fig. 1).

Conclusion: The non-ambiguous LORETA coherency results differed remarkably from the scalp coherency results. Scalp coherency results, in addition depended on the chosen reference location as to be expected.

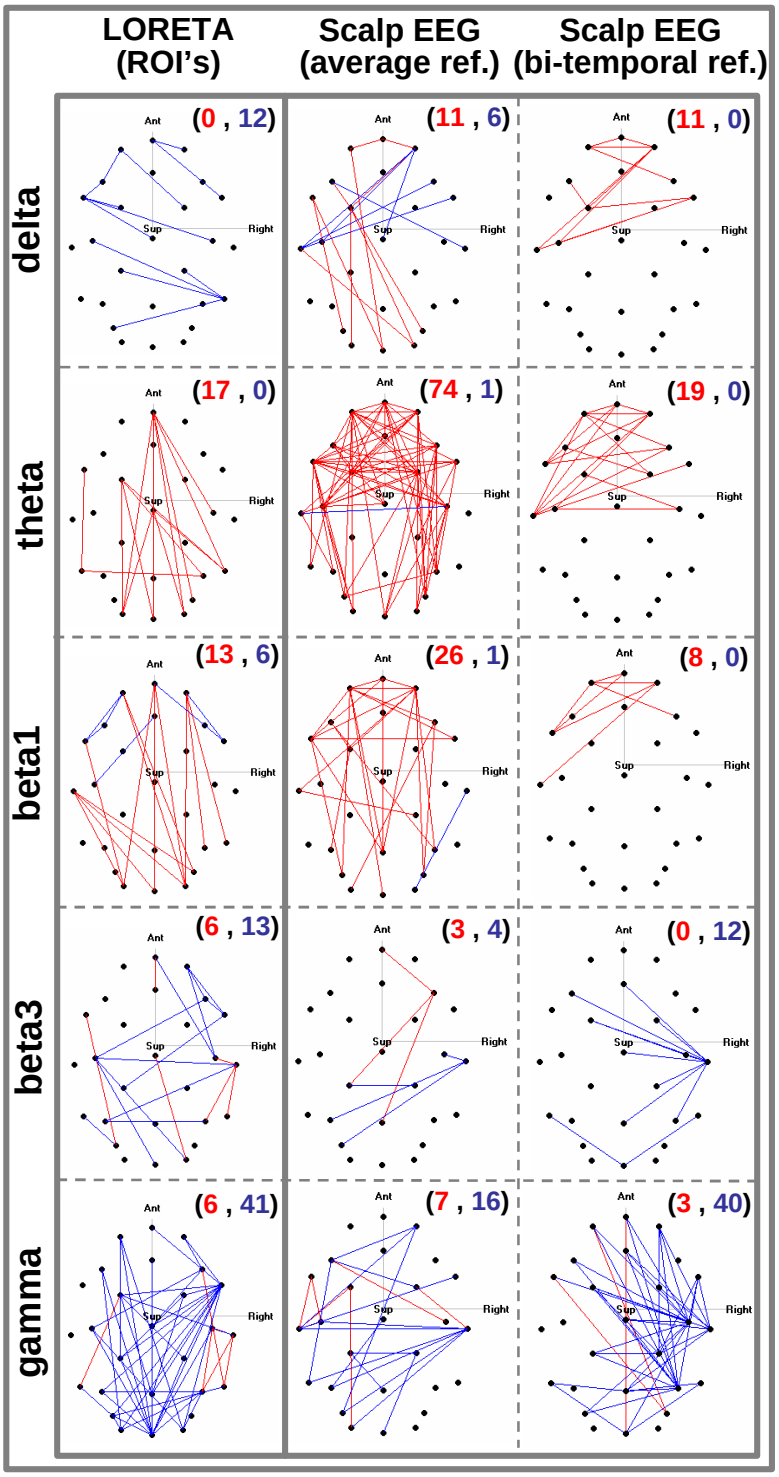

Fig. 1 : Red (blue) lines: significant higher (lower) coherency in meditation (p<0.05) compared with resting. In brackets: number of cases at p<0.05; red higher, blue lower in meditation.

References: Pascual-Marqui, R.D., Michel, C.M. & Lehmann, D. (1994). Low resolution electromagnetic tomography: a new method for localizing electrical activity in the brain. International Journal of Psychophysiology, 18: 49-65.