Sampling rate in TMS-EEG coregistration: Any benefits over 5000 Hz?

Zazio Agnese[1], Barchiesi Guido[1], Bortoletto Marta[1]

[1] Neurophysiology Lab, IRCCS Istituto Centro San Giovanni di Dio Fatebenefratelli, Brescia, Italy

Concurrent transcranial magnetic stimulation and electroencephalography (TMS-EEG) is a highly promising technique in neuroscience research, which combines the opportunity of directly activating a target brain area – by means of TMS – and to record the spread of neural activation with an excellent temporal resolution – via EEG. Although important advances in off-line analysis have been made in recent years, the TMS-induced artifact still represents a major challenge in TMS-EEG recordings. Importantly, it is known that increasing sampling rate can reduce the duration of the TMS artifact because it allows to increase the low-pass anti-aliasing filter. However, it is not known how much reduction occurs at sampling rates higher than 5000 Hz.

Here, we recorded TMS-EEG data from a phantom head model made with a melon, using an EEG montage of 5 electrodes. Three variables were manipulated: sampling rate (4800 Hz, 9600 Hz, 19200 Hz, 38400 Hz), TMS intensity (40%, 70%, and 100% of maximal stimulator output), and stimulator model (Super Rapid, Magpro and Nexstim). For each condition, 40 TMS pulses were recorded.

We will show the effects of increasing sampling rate on TMS artifact duration for different intensities and TMS models.

Our results will provide additional information on the acquisition parameters that may affect the TMS-induced artifact. If our hypothesis is correct, together with appropriate analysis pipelines, increasing the sampling rate in future TMS-EEG recordings will allow to investigate the earliest TMS-evoked potential components within the first 10 ms, and possibly the neural response of the stimulated area beneath the TMS coil.