

Activation of human cortical motor areas during self-initiated finger movements*

Chayanov N. V.¹, Prokofyev A. O.^{1,2} /a_o_p@mail.ru/, Morozov A. A.³, Stroganova T. A.^{1,2}

¹ MEG-center, Moscow State University of Psychology and Education, Moscow, Russia

² Psychological Institute Russian Academy of Education, Moscow, Russia

³ Institute of Radio Engineering and Electronics, Russian Academy of Sciences, Moscow, Russia

The study aimed at localization of the hand area of primary motor cortex using magnetoencephalography (MEG). Based to the literature (Shibasaki and Hallett, 2006), we expected that the source of averaged magnetic fields in the peak of the “readiness field” (RF) component of the motor evoked response will be localized in the hand area of primary motor cortex M1 (“omega-like” part of the central gyrus) contralaterally to the moving finger .

We evaluated cortical sources of the evoked magnetic field preceding the onset of voluntary lifting of the index finger in seventeen healthy subjects. For the movement onset detection we used automatic detection procedure based on a moving window-based computation of variance of the accelerometer signal. For each subject, at least 150 epochs were averaged. The sources of averaged magnetic fields in RF peak were fitted with a single dipole model. Only estimates with a goodness of fit above 85% were analyzed.

Results showed that at the group level the magnetic fields source localization in RF peak agreed well with the existing finding of the location of the primary motor hand area. However, at the inter-individual level the sources of the RF peak spread widely across the sensorimotor complex, being localized in the primary motor or sensory or premotor cortical areas of the contralateral hemisphere.

These findings indicate the presence of the simultaneous multiple sources of the magnetic field at the time immediately preceding the movement onset. Our data are in a good agreement with animal literature suggesting the involvement of neural populations of the somatosensory and premotor cortex into the movement preparation (Donoghue and Wise 1982; Murphy, Wong et al. 1985; Widener and Cheney 1997).

Our results point to an inadequacy of the single dipole modelling for sources localization of motor readiness field. This conclusion is important for application of MEG-based cortical motor mapping in clinical settings.

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