ECRONICON OPEN ACCESS

EC PSYCHOLOGY AND PSYCHIATRY
Investigational Paper

MEG and Pico-Tesla-TMS in Patients with Migraine, Depression or Schizophrenia

P Anninos[1]*, A Kotini[1], A Adamopoulos[1] and N Tsagas[2]

[1]*Laboratory of Medical Physics, School of Medicine, Democritus University of Thrace, Alexandroupoli, Greece*

[2]*Department of Electrical Engineering, Polytechnic School, Xanthi, Greece*

***Corresponding Author:** Emeritus Professor Photios Anninos, Laboratory of Medical Physics, School of Medicine, Democritus University of Thrace, Alexandroupoli, Greece.

Received: September 06, 2017; **Published:** September 21, 2017

Magnetoencephalography (MEG) is a well-established noninvasive method for investigating human brain activity. Trancranial Magnetic Stimulation (TMS) has been used as an extra alternative means for treatments for patients suffering from neurological disorders as a non-invasive method to stimulate the human brain.

In our lab, Professors Anninos and Tsagas invented a pico-Tesla (pT) (1pT-10^{-12} T)-TMS electronic device [1], that can increase the (2 - 7Hz) abnormal frequencies of the recorded MEG for patients with migraine, depression, or schizophrenia towards frequencies of less or equal to its frequencies of the alpha frequency range (8 - 13Hz) (Figure 1A). The pT-TMS electronic device is a modified helmet containing up to 122 coils that cover the 7 brain regions: Frontal, Vertex, Occipital, right-left Temporal and right-left Parietal. The pT-TMS electronic device produces modulations of the magnetic flux (intensity: 1 - 7.5pT) in the alpha frequency range (8 - 13Hz) of each patient.

In our lab, we used a whole-head 122 channel gradiometer device (Neuromag-122, Neuromag Ltd, Helsinki, Finland) located in an electromagnetically a shielded room in order to avoid extraneous electromagnetic noise (Figure 1B). In addition we have a one channel second order gradiometer MEG system (model 601 of the Biomagnetic Technologies Inc) located in the same shielded room (Figure 1C). The MEG recordings from the one-channel system were performed after positioning the MEG sensor 3 mm above the scalp of the patient, with the use of an optic positioning system, which was based on the International 10 - 20 Electrode Placement System. The reference system was devised to retrieve maximal information from a specified area of the skull given that the gradiometer coil is theoretically equally sensitive to all magnetic flux lines perpendicular to a circular area of the brain.

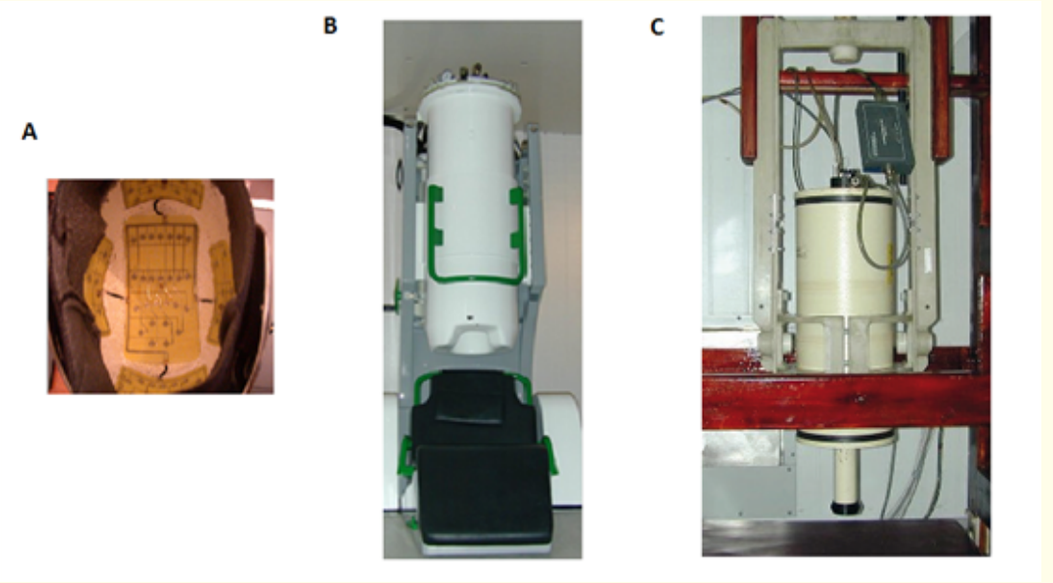

***Figure 1:** A) The configuration of the stimulation coils within the helmet of the electronic device. B) The 122 channel MEG system inside the shielded room C) The one-channel MEG system inside the room.*

It is known that magnetic fields modify the activity of the pineal gland, that has been shown to control dopaminergic, and endogenous opioid functions. On a cellular level, the consequences of magnetic fields might be related to alterations in properties and constancy of biological membranes and their transport characteristics including their intra- and extra cellular distributions and flux of calcium ions. A further explanation is based on Morrell's theory that every stimulus entering the brain is maintained for a definite period of time representing the short-term memory of the particular stimulus occurrence [2-6].

By using the pT-TMS the electronic device in the above patients with abnormal MEG activity and symptoms we have demonstrated that most of the patients were shown quantifiable benefit. In conclusion using the external weak pT-TMS we were able effectively to attenuate in our lab the majority of the symptoms in patients with migraine, depression or schizophrenia [2-6]. This technique of the pT-TMS has potential effects to be a noteworthy non-invasive safe and effective modality in managing the symptoms of the above patients. However, further research with more patients are required before firm conclusions can be drawn.

The protocol from the above research was approved by the Research Committee of our Democritus University of Thrace. Funding for this work was provided by a collaboration of General Secretariat of Research and Technology, GR and the ERGO AEBE,INC,GR under a research program (Grant Number: 80623).

Bibliography

1. PA Anninos and N Tsagas. "Electronic apparatus for treating epileptic individuals. US patent 5453072" (1995).

2. P Anninos., *et al*. "pico-Tesla Transcranial Magnetic Stimulation on Depression patients with double blind experimental design". *Neurology and Neurotherapy* 2.1 (2017): 000112.

3. P Anninos., *et al*. "MEG study of pico-Tesla Transcranial Magnetic Stimulation on patients with Depression". *EC Neurology* 5.3 (2017): 115-122.

4. P Anninos., *et al*. "The effect of pico-Tesla external transcranial magnetic stimulation on migraine patients". *EC Neurology* 4.5 (2017): 163-170.

5. P Anninos., *et al*. "MEG as a Medical Diagnostic Tool in the Greek Population". *Acta Medica (Hradec Kralove)* 58.3 (2015) : 71-78.

6. A Kotini and P Anninos. "Detection of non-linearity in schizophrenic patients using magnetoencephalography". *Brain Topography* 15.2 (2002): 107-113.

Volume 5 Issue 4 September 2017