EEG EFFECTS OF TRANSCRANIAL MAGNETIC STIMULATION AT pT RANGE.

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OBJETIVES

We aim to obtain a model or pattern among normal subjects. Thus, we are subsuming a diagnostic method (digital EEG) and a therapeutic one, which is the physiological TMS (Transcranial Magnetic Stimulation), into a new technique, pending validation. This new technique will be able to obtain an electroencephalographic response and to quantitatively evaluate the alteration of cerebral rhythms in healthy subjects, (pattern for normality), employing physiological TMS at 10 pT (picotesla) and 8 Hz, simulating the alpha rhythm. The study is single blind and the subjects do not know when they are being stimulated .

METHODS

We have employed digital EEG, mod. SAM 32 FOFC 1, with System PLUS Software by Micromed, latest version, and spectral analysis by FFT (Fast Fourier Transform). The sample was made up of 16 healthy subjects with their eyes open, half males and half females. The recording cap, which is elastic has twenty Ag/AgCl electrodes (SIEMENS) placed bilaterally and is electrode-glued onto the scalp of the subject. The 10/20 IS (International System) of electrode placement is used. EEG signals are collected from 18 channels, filtered through a 0.5 Hz – 70.0 Hz band filter and sampled at 128 Hz. We have also used a TMS prototype stimulator, mod. MG28TR10, which incorporates a timer for the EEG recorder to control the stimulation periods and pauses (1.5 min followed by a 1 min pause). Twenty magnetic stimulation coils are placed on the EEG recording elastic cap at a distance of 2 cm between them and the recording electrodes. This way, stimulation and recording can be carried out without interference (Fig. 1 and Fig.2).

RESULTS

A global increase in the alpha and beta rhythms has been observed as well as a decrease in delta and theta. Alpha and delta register the highest increase and decrease, respectively. A 17.5% increase in alpha rhythm and a 4.5 % in beta are performed at the expense of a decrease in delta and theta rhythms.
The most relevant increase in alpha rhythm, as the stimulation was going on, was registered at the Fp1, Fp2, F3 and F4 frontal electrodes, as well as at the central Cz (Fig. 3 and Fig. 4).

CONCLUSIONS

By means of the TMS at 10 pT and 8 Hz, we obtain a mimetic global bioelectrical neuronal response, as the alpha rhythm magnetic field is simulated and the brain is timed to it. We also find an alpha rhythm displacement towards frontal and central areas of the brain

Fig. 1.- TMS stimulator, mod. MG28TR10 (left). Subject sitting inside the Faraday chamber. Recording cap and amplifier are also shown here, (right)

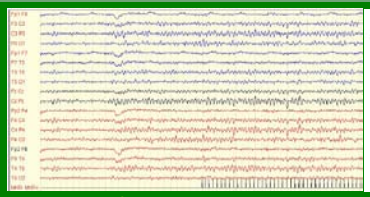

Fig 2.- Beginning of the stimulation process. We can see a lower channel designed to observe the morphology and frequency of the stimulus. The stimulus-pause sequence allows for both he ulterior elimination of traces of stimulus and analysis of the pause tracks as though it had been done with a non-stop recording.

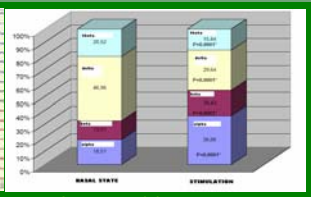

Fig 3.- Comparison of frequency-percentage histogram. Redistribution of brain rhythms (alpha, beta, delta and theta), mean value of all the electrodes

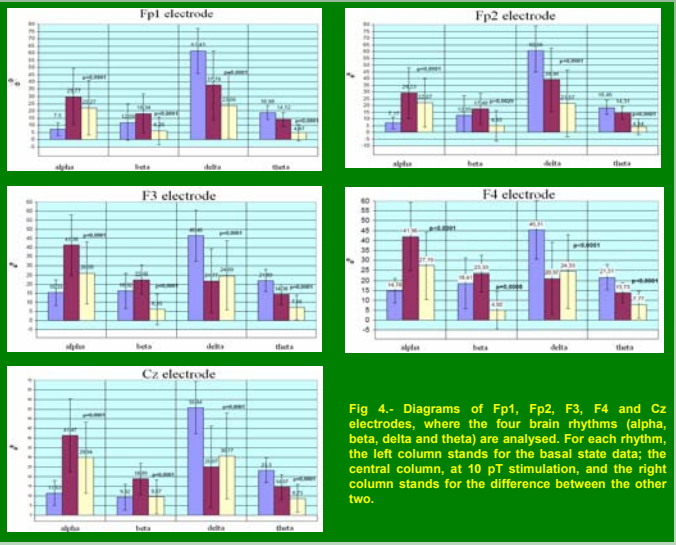

Fig 4.- Diagrams of Fp1, Fp2, F3, F4 and Cz electrodes, where the four brain rhythms (alpha, beta, delta and theta) are analysed. For each rhythm, the left column stands for the basal state data; the central column, at 10 pT stimulation, and the right column stands for the difference between the other two.

REFERENCES

— Bardasano *et al*: 2006, Equipment for Magnetic Field Treatment for Neurodegenerative Illnesses. *Bol. Ofic. Prop. Industr. 1780,* (In Spanish).

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