The Characteristics on the metamorphosis of cell application for Transcranial Magnetic Stimulation

Whi-Young Kim*
[1]Department of Biomedical Engineering Dongju college University, 15-1 San, Koijeng-dong, Saha-gu, Busan 602-715, Korea

1. Introduction

To supplement the various problems of transcranial magnetic stimulation, this thesis mainly employed the method for controlling the action time and changing the pulse repetition rate by the output pulse of transcranial magnetic stimulation for controlling the energy density. The pulse repetition rate was changed to design and produce transcranial magnetic stimulation of a delay time pair control method, which is more compact and economical than the previous power device in order to control the energy density. AVR one chip microprocessor was grafted to safely control the circuit operation. Transcranial magnetic stimulation was operated as a power device and control section, and research was carried out on the characteristics of motion and output of transcranial magnetic stimulation according to the current pulse waveform and the repetition rate of stimulation coil.

2. Materials and Methods

2-1.Research model

This study designed and produced transcranial magnetic stimulation using a delay time pair control method, which is simpler and more economical than the previous power device, to control the energy density by changing the pulse train repetition rate. Transcranial magnetic stimulation is generally formed of a charge/discharge device, control device, and stimulation coil. The power device was designed and produced to use a shift charge/discharge method to operate the stimulation coil, and the control section used an AVR-one chip microprocessor of the ATMEL Company to achieve stable system operation. To stimulate the nerves through a magnetic pulse, the electric field induced by the time varying magnetic field must be composed of a size that can stimulate nerves. An electric field composed of dozens of V/m must be induced in the neural area. To induce an electric field of such size, an electric field of 1~2 Tesla must be switched in a short period of time (200μSec) in the shape of a stimulation coil and neural area in the epidermis.

2-2. Magnetic stimulation device of Recharge approach

The eddy current induced by time varying magnetic field employs an electrode within human body to produce the identical effect of a directly injecting current. The control and operation device of transcranial magnetic stimulation using a pair-control method is applied. The power circuit is composed of a main circuit and triggers an operation circuit. The main circuit is operated by dividing the pulse repetition rate designated by the condenser of each section. If the designated pulse repetition rate is 10 Hz, C1 and C2 operates using a 5Hz pulse repetition rate.

2-3. Behavioral test

A high-output can be gained as more energy is saved in the condenser due to the acquisition of a larger charging time compared to the time gained during the operation of a single condenser. For economic feasibility, a commercial frequency condenser can be employed using the previous high-frequency condenser as the Pair-control charge/discharge method. Circuit operation complies with the motion order of the IGBT. First, energy charged in C1 is discharged as the stimulation coil when gates 2 and 3 are turned on, and C2 simultaneously begins charging. Next, the energy charged in C2 is discharged as the stimulation coil when gates 1 and 4 are turned on, and C1 simultaneously begins charging. This order is operated by controlling the gate signal of the IGBT. It is designed to process simultaneously the transcranial magnetic stimulation monitoring system required in total motion as well as the interlock with the surrounding components. The aim is to minimize the effect caused by the gate trigger pulse on the turn-off time of each IGBT. All gate trigger pulses with a sine wave form were converted to waveforms of a short pulse range by passing through the differentiating circuit to gain the maximum pulse repetition rate. The converted pulse was sufficiently amplified as the SCR gate operation current using Tr. Fig. shows each fMRI, PET-MR, FDG-PET rat brain templelate.

3. Results

The output was measured by varying the repetition rate Hz and simultaneously changing the constant circuit. The voltage presents the voltage charged in the condenser and does not refer to the ΔV inserted in energy transmission. An adjustment of Hz was achieved by installing an autonomously designed, produced keyboard in the control section and enabling the input of the desired Hz. Fig 3 the shows the various experimental methods. Fig 4 showing the coil of the magnetic stimulation devices that are designed and implemented. Experiment sets the charged voltage of C1 and C2 to 1000 V and the pulse repetition rate to 35Hz and presents the current waveform of the stimulation coil when there is no delay time. Indicating that simulates the process of forming the magnetic flux is in the YZ direction Experiment the current waveform of the stimulation coil during a 1,000V charged voltage to the condenser without a delay time and when the delay time is 100㎲. The current and voltage were measured using a high-voltage probe (Probe X 6,000 V, Lecroy) and a Rogowski current waveform transducer (CWT, Penmuk). Fig. Induction of global ischemia through common carotid artery occlusion after induction of anesthesia. Fig. The stimulation pulses to 5~30 minutes discharge shows the change in the bacteria. The number of bacteria in the first 4.6 x 105cfu/ml, are significantly reduced over time. Stimulation time to 20 minutes when the bacteria numbers were changed to 1.6 x 105cfu/ml. Fig. output characteristics according to the superposition rate of transcranial magnetic stimulation. Fig. 10 the time evolution of the Transcranial Magnetic Stimulation output power at the conduction of the blocking capacitor of 1uF and input power of 330 W. Furthermore, although the output efficiency of the stimulation coil decreased with increasing pulse repetition rate, the output showed an increasing tendency.

4. Discussions

This study designed and produced a power device using a delay time pair control method to compare and examine the current waveform of the stimulation coil as well as the output characteristics of transcranial magnetic stimulation. In conclusion, the delay time pair control method was applied to a transcranial magnetic stimulation power device to replace the previous expensive high-frequency condenser with a commercial frequency condenser, which is inexpensive and commercially available, making the system more economical. More energy can be saved in the condenser to gain a high-output as a larger charge time can be acquired compared to the operation with a single condenser. When the charged voltage of condenser was increased in the range of 900V~1.2kV and the pulse repetition rate was increased by 25Hz in the range of 20~100Hz, the output efficiency of the transcranial magnetic stimulation decreased with increasing pulse repetition rate. On the other hand, a regular output increase of 300W, 400W, 500W and 600W was observed with charged voltages of 900V, 1kV, 1.1kV and 1.2kV, respectively. As a result, we can obtain good changing characteristics of various bacteria by adjusting the charging voltage, the treatment pulse forming and the Magnetic field inducing time.

References

[1] Walsh V, Pascual-Leone A.: Transcranial magnetic stimulation: a neurochronometrics of mind. Cambridge, MA: MIT Press: 2005.

[2] Sun-Seob Choi, et al.: Transcranial Magnetic Stimulation with Applied Multistep Direct Current Grafting, Biomedical Engineering: Applications, Basis and Communications, 2013: 1350032,1-6.