P1-003 DESIGN OF THE AIR-CORE TRANSCUTANEOUS TRANSFORMER FOR AN ARTIFICIAL HEART CONSIDERING THE ELECTROMAGNETIC INFLUENCE ON BIOLOGICAL TISSUE

K. Shiba, M. Nukaya, T. Tsuji
Hiroshima University, Higashi Hiroshima, Japan

Background: Transcutaneous energy transmission (TET) is the most promising method for supplying energy to an implanted artificial heart using electromagnetic induction. However, the electromagnetic influence of TET on biological tissue has not been investigated. **Methods:** The specific absorption rate (SAR), which is defined as the power absorbed into biological tissue per unit mass [W/kg], and the current density, which is defined as the current magnitude per unit area [A/m^2] in biological tissue surrounding the aircore transmission coils, are analyzed by the electromagnetic simulator. The analysis model has three layers including the skin, fat and muscle. The transmission frequency (0.2–1 MHz), the output voltage (12–24 V), the transmission coil's diameter (basic model: 90 mm and large model: 100 mm), are varied at a power output of 20 Watts. **Results:** The SAR is sufficiently small at any given transmission condition, about 2–14 mW/kg, compared to the restrictions of the ICNIRP. However, current density exceeds the restrictions in the basic model, about 11–17 A/m^2. It is possible to transfer energy below the restrictions only when the frequency is over 650 kHz and the output voltage is 12 V, using the large model. The results show that current density decreases as the frequency rises, the output voltage falls, and the coil's diameter increases. **Conclusion:** The electromagnetic influence has a close relationship to the frequency, output voltage and coil dimension. It is concluded that the design of the TET in consideration of SAR and current density is important to make TET practical and safe.