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Numerical Estimation of SAR Enhancement Characteristics Due to Implanted Metal Plates Exposed to Oblique Incidence Plane Waves

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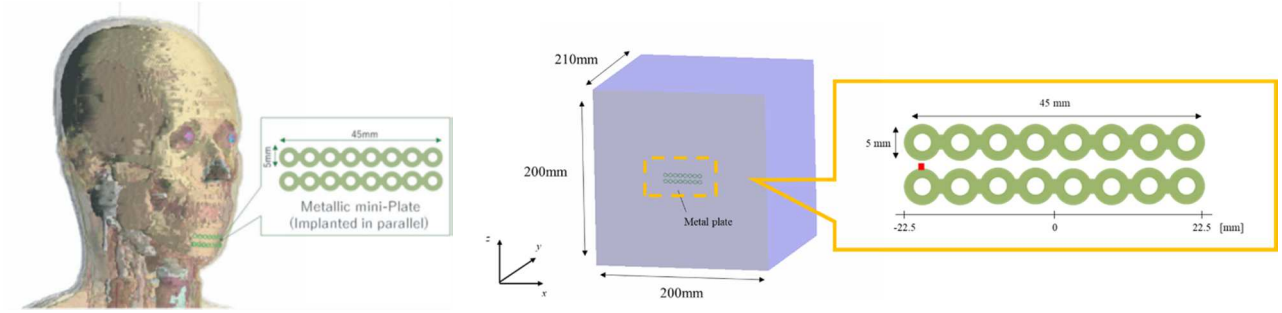
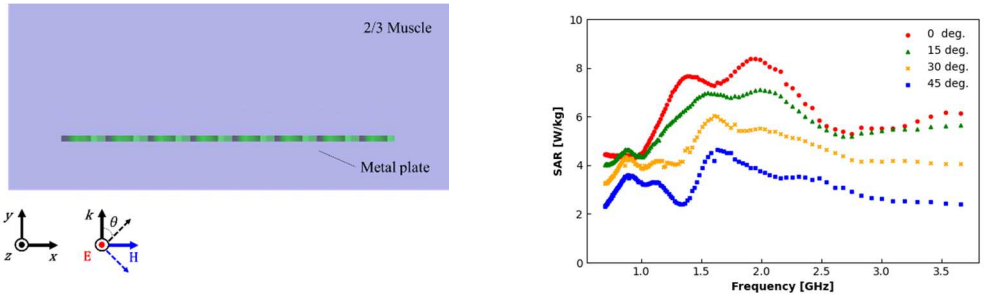
In this presentation, the novel estimation of SAR (Specific Absorption Rate) enhancement due to implanted metal plates is introduced. Recently, many types of medical devices, such as implantable cardiac pacemakers and implanted metal plates. In addition, the mobile communication system is widely used in our daily life. Therefore, the effect on these devices exposed to the electromagnetic field is one of the most important issues. A lot of studies have been conducted to solve this problem in many organizations. However, there is a concern about the temperature increase when the metallic devices are placed inside the human body. In this study, we focused on the implanted metal plate used for the treatment of mandibular fractures and analyzed the SAR enhancement in human tissue by numerical simulation based on the finite difference time domain (FDTD) method.

Figures 1(a) and (b) show the numerical model for numerical estimation. It consists of 2/3 equivalent and two metal plates with holes. We assume that the metal plates are exposed to the plane wave in the frequency range of 0.7 - 3.6 GHz (4G/LTE frequency bands). The arrival angle of the exposed plane wave (wavevector k) was changed to 0, 15, 30, and 45 degrees in the x-y plane, as shown in Fig. 1(c).

Figure 1(d) shows the SAR enhancement at the cell marked in red in Fig. 1(b). When the angle of a wave vector was changed from 0 to 45 degrees, the first peak of SAR enhancement moved to a higher frequency. However, the maximum value was observed when the angle was 0 degrees. In other words, the SAR is highest when the plane wave arrives from the front of the metal plates. In the future, we plan to evaluate the characteristics in other exposure scenarios, including other shapes of metal plates, polarization, and so on.



(a) Human head with implanted metal plates (b) Numerical model



(c) Arrival angle of a plane wave (d) SAR enhancement at each frequency

Figure 1. Numerical estimation of SAR enhancement due to implanted metal plates

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