An Experimental Estimation for SAR Enhancement Due To Implanted Metal Plates Using Thermographic Method

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RF exposure guidelines\[1-3\] recognize that an increase in local SAR due to metallic implants is possible, depending upon the size and shape of the implant and the position. Some papers regarding interaction of radio frequency (RF) EMF and passive metallic implants have been published \[4-5\]. This study describes the local SAR calculations for human with metallic osteosynthesis plates embedded in the mandibular zone exposed to RF fields. The main objective is to assess whether combination of two metallic plates aligned in parallel in the head region could be expected to cause SAR enhancements under near-field exposure condition at 2 GHz \[6\]. In this paper, we achieve temperature distribution measurements for a phantom implanted with osteosynthesis plates. A physical phantom implanted with two metallic plates is developed and thermographic method are used to obtain temperature distribution. The solid phantom was manufactured using silicone rubber and carbon material. The obtained measurement data can be used for validation study for further SAR estimations using numerical analysis. After 10 seconds RF exposure, when the antenna input power was set to be 500 W, the temperature distribution was measured immediately in front of the plate of the phantom. Figure 1 shows examples of surface temperature distributions of the phantom. In the temperature distributions, temperature increase due to the metallic plates was clearly observed near the plate region. In addition, the measured result agreed well with numerical simulation result obtained using a commercially available FDTD simulation software \[7\]. Local SARs for a human model with osteosynthesis plates in the head region were also evaluated. By using an anatomical phantom implanted with metallic plates at the median mandibular, the effect of combination of two metallic implants, were estimated under near-field exposure condition at 2 GHz. The results indicated that the increase rate was 34% under the condition.

![Temperature elevation due to implanted metal plates](image)

Figure 1. Temperature elevation due to implanted metal plates.

References