

## Evaluation of Metal Structures Heating During Magnetic Resonance Imaging

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### Abstract

The paper presents a description of the nature of thermal processes and a method for metal structures heating evaluating in MRI, as well as the results of a series of experimental studies: passive implants and other metal objects were placed in the isocenter of the magnet and on the periphery, while being in the air, water, in gel or under heat insulating material. To study the heating, T2 FASE pulse sequence was used, and the temperature of the samples was recorded using fiber optic sensors.

It is shown that the heating of metal structures is determined by both the properties of the object and the characteristics of the MR tomograph, as well as the scanning conditions, materials surrounding the object and its position in the MRI gantry. For the peripheral location of the phantom and an extended stainless-steel implant, a maximum heating of 2,5 °C was recorded in 15 minutes. When placed at the isocenter, the temperature of the samples increased by no more than 0,5 °C in 15 minutes, which indicates the possibility of conducting an MR study without exceeding the limitations associated with the amount of tissue heating.

The results of the work demonstrate the necessity to take into account the magnitude of the possible heating of a metal object when deciding on the possibility of an MRI study for patients with metal structures.

**Key words:** Magnetic Resonance Imaging, Metal Structures Heating, Implantable Medical Devices, Patient Safety, Prosthesis and Implants.

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