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Estimation the tumor temperature in magnetic nanoparticle hyperthermia by infrared thermography: phantom and numerical studies

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Abstract

The treatment of cancer by hyperthermia requires prediction, monitoring and control of the temperature within the tumor. Infrared thermography (IRT) was presented in this paper as a noninvasive temperature monitoring method used in magnetic nanoparticle hyperthermia (MNH). We tried to use this surface temperature measurement method to get information about the intratumoral temperature. Experimental *in vitro* MNH studies were performed on gel tumor-tissue phantoms which were constructed to simulate the real tumor and overlying healthy tissue. Magnetic nanoparticles were dispersed uniformly in the tumor part of phantom. During the process of *in vitro* MNH, an alternating magnetic field (AMF) was applied for heating, an IR thermal camera monitored the surface temperature and a fiber optical sensor measured the tumor temperature. A numerical finite element models of thermal analyses was built to simulate the MNH phantom experiments. Both experimental and numerical results indicate that the temperature difference between the surface hot spot and the tumor inner will