

AbstractID: 8818 Title: Nanoshell-Mediated Laser Induced Thermal Therapy in an In Vivo Model

Purpose:

To evaluate the thermal response of intravenously-injected laser-activated gold-silica nanoshells in an *in vivo* tumor xenograft model using MRTI and histopathology.

Method and Materials:

PC3 cancer cells were inoculated subcutaneously on the backs of SCID mice and allowed to grow to ≤ 1 cm diameter before treatment. Gold nanoshells (Nanospectra Biosciences Inc., Houston, TX) were injected intravenously in experimental mice. Saline was injected in control mice. Twenty-four hours post-injection the tumors were irradiated extracorporeally for 3 minutes by a coherent, near-infrared diode laser (808 nm). Laser output was 4 W cm^{-2} to all tumors. Spatiotemporal temperature distributions in the tumors were monitored in real-time during procedures by Magnetic Resonance Temperature Imaging (MRTI). Maximum temperatures and temperature profiles with respect to depth were measured from the MRTI data and the depths at which thermal ablation occurred were determined. Depths to which necrosis was induced and areas of necrosis relative to tumor areas were measured from histological (H&E) images.

Results:

There was a statistically significant difference in maximum temperature changes achieved ($40.9 \pm 2.6^\circ\text{C}$ with nanoshells versus $19.2 \pm 2.7^\circ\text{C}$ without) ($p < 0.001$). The average temperature increase in the nanoshell mice caused greater amounts of necrosis in tumors, in terms of depth (2.7 ± 1.7 mm versus 0.1 ± 0.2 mm) ($p < 0.01$) and relative area ($67\% \pm 37\%$ versus 0%) ($p < 0.001$). The depths to which ablative temperatures could be achieved for standard body temperature were also greater ($p < 0.05$) in nanoshell mice (2.8 ± 0.7 mm with nanoshells versus 0.4 ± 0.6 mm without.)

Conclusion:

Laser-induced ablation can be induced in nanoshell-containing tumors at otherwise sub-lethal laser powers.