Photodynamic Therapy Induced Microvascular Changes Assessed by Photoacoustic Microscopy

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Photoacoustic microscopy (PAM) is an emerging non-invasive, high-resolution imaging technique used for superficial imaging of blood-related parameters in vivo without the use of contrast agents. Based on the photoacoustic effect, I used a high-repetition, pulsed, 532nm laser to induce an emission of ultrasonic signal upon the direct excitation of deoxy-hemaglobin and oxy-hemaglobin. The laser was spatially filtered and collimated before being focused so that I could achieve a relative spot size of about 7um; imperative for maximum lateral resolution. Once excited, the signals emitted by the vasculature are then captured by an unfocused, 10MHz transducer, analyzed, and plotted on a relative scale of intensity to create a 2D image. PAM's ability to image microvasculature can be used to quantify and assess the earliest affects and results of vascular diseases and vascular-related treatments such as photodynamic therapy (PDT). In this experiment, I used a custom PAM setup to image and assess PDT response on the angiogenic vasculature of a Gli mouse with near real-time results. I mapped the microvasculature network before, during, and after treatment, and clearly saw a dramatic decrease in structurally-sound vessels, providing evidence of successful PDT.

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