University of Rochester
Department of Biomedical Engineering

M.S. Defense Seminar

"Fluorescence Spectroscopy of a Targeted Photosensitizer for Photodynamic Therapy of Breast Cancer"

by
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Zoom: https://rochester.zoom.us/j/94850941933

Abstract:

Photodynamic therapy (PDT) is a minimally invasive cancer treatment that combines a photosensitizer, light, and oxygen to generate reactive oxygen species (ROS) that destroy tumor cells. While clinically useful, PDT optimization is challenged by variations in photosensitizer uptake, light distribution, and oxygen availability. Effective treatment planning requires accurate, real-time monitoring of these parameters. In this study, we developed a custom fluorescence spectroscopy system to enable continuous, *in vivo* monitoring of PDT in murine breast cancer models. Fluorescence spectroscopy was used to assess the uptake and photobleaching of pyropheophorbide-a (Ppa), a second-generation photosensitizer. The system incorporated reflectance-based correction and Singular Value Decomposition (SVD) fitting to account for tissue absorption and scattering and to separate Ppa fluorescence from background autofluorescence. After validation with tissue phantoms, the system was applied in animal studies involving BALB/c mice bearing EMT6 tumors.

Mice were treated with either targeted or untargeted Ppa and exposed to light after 1- or 4-hour drug-light intervals. Results showed that the 4-hour interval led to greater Ppa accumulation in tumors, with targeted Ppa exhibiting higher fluorescence than untargeted formulations. Photobleaching was monitored as an indicator of photosensitizer activation and ROS generation. Although photobleaching did not correlate strongly with tumor doubling time, cured tumors showed increased photobleaching compared to those that regrew, suggesting a potential link between photobleaching and treatment efficacy.

Kaplan-Meier survival analysis confirmed improved tumor control in PDT-treated mice, especially those receiving targeted Ppa with a 4-hour interval. These findings support the use of real-time fluorescence spectroscopy as a valuable tool for PDT dosimetry. Future studies will apply this system to head and neck tumor models to enhance fluorescence-guided treatment planning and individualized PDT strategies.