AbstractID: 4537 Title: Reconstruction of spatially varying optical properties of human prostate during metexafin lutetium PDT

Purpose: The purpose of this study is to characterize the internal optical absorption and reduced scattering distribution of human prostate during the interstitial metexafin lutetium photodynamic therapy (PDT). These distributions could be utilized in PDT treatment planning, which optimizes the arrangement and weighting of interstitial light sources to ensure sufficient photon are delivered to the treatment volume.

Method and Materials: A continuous-wave diffuse optical tomography system has been developed using a finite element reconstruction algorithm based on diffusion approximation of light distribution in biological tissue. Reconstructed images are presented from simulated data and clinical data acquired from prostate cancer patient being treated by PDT. Source-detector arrangement is identical in simulated data and patient data. The contour of prostate was obtained using ultrasound imaging. The meshes were generated by MATLab PDE Toolbox.

Results: The synthetic measurement data were calculated for a rectangular phantom containing a single absorption anomaly and a single scattering anomaly. The model had a background of $\mu_a=0.03mm^{-1}$, $\mu'_s=1.4mm^{-1}$. The absorption anomaly was located at (15mm,15mm), with a radius 5mm, $\mu_a=0.06mm^{-1}$; the scattering anomaly was located at (35mm,10mm), with a radius 5mm, $\mu'_s=2.0mm^{-1}$.A total number of 5 sources and 12 detectors yielded 60 measurements (12 detectors ×5 sources). The reconstruction basis uses a coarser mesh (100 nodes) to reduce the degree of freedom. The reconstruction images successfully recover the both anomalies with good localization. The clinical DOT imaging was performed on 70-year old male subject. The reconstructed prostate μ_a varied between 0.025 and 0.07 mm^{-1} and μ'_s ranged from 1.1 to 2 mm^{-1}. These results are consistent with previous measurement using a point-by-point method.

Conclusion: We have shown that this modeling and reconstruction algorithm can produce fast and reliable images of internal optical properties with fast computation time.

Conflict of Interest (only if applicable):NA.