AbstractID: 11495 Title: Reconstruction of absorber concentration using a linear source model for interstitial spectroscopic diffuse optical tomography

Purpose:

Light, photosensitizer and oxygen are the major components of Photodynamic therapy (PDT). With the implementation of interstitial diffuse optical tomography (iDOT), the optical properties of tumor tissue can be reconstructed spatially using an inverse algorithm. Further, the spatially-resolved hemoglobin oxygen saturation and sensitizer distribution are expected to be established with the reconstructed optical properties. In this study, we incorporate a spectroscopy system with the existed iDOT to reconstruct the spatial distributions of absorber concentration. We especially focus on linear source system, because the acquisition time for a linear source system is much shorter than that for a point source system, making it more suitable for clinical use.

Methods and Materials:

A spectroscopic iDOT system has been developed to characterize the hemoglobin oxygen saturation and sensitizer concentration of the prostate gland during PDT. During data acquisition, isotropic detectors and the cylindrical fibers coupled to a white light source are inserted into the prostate gland, and absorption spectra are acquired along the detector insertion axis under the control of a motorized system. For our CW iDOT system, two dimensional optical properties of the prostate gland are reconstructed by solving the inverse problem with the use of an adjoint model based on diffusion theory.

Results:

To verify the accuracy of our methodology, we have performed measurements in an optically heterogeneous solid tissue-simlulating phantom of known composition. We compare the spatial distribution images of optical properties and absorber concentration reconstructed for the phantom with the known results based on material composition. Results of clinical data reconstruction are also shown in this study.

Conclusion:

The results demonstrate that it is feasible to reconstruct the optical properties of the sample and the distributions of absorbers with known absorption spectra, indicating that reconstruction of hemodynamic and drug concentration *in vivo* is practical in clinical applications.