AbstractID: 3603 Title: Determination of optical properties in semi-infinite media

Purpose: To develop a method to quickly determine tissue optical properties (absorption coefficient μ_a and transport scattering coefficient μ_s') in a semi-infinite medium.
Method and material: Optical properties where determined by measuring the ratio of light fluence rate to source power along a linear channel at a fixed distance (4 mm) from an isotropic point source. The light detection system consists of two parallel light transmitting catheters placed 4mm apart. Diffuse light, from a 2mm cylindrical diffusing tip, is collected by an isotropic detector with a 0.5mm scattering bulb whose position is determined by a computer controlled step motor, with a positioning accuracy of better than 0.1 mm. The system automatically records and plots the light fluence rate per unit source power as a function of position. The result is fitted with a diffusion equation to extrapolate μ_a and μ_s'. Measurements where made in liquid tissue simulating phantoms, with known reduced scattering coefficient (μ_s') and absorption coefficient (μ_a). A theory based on light source on semi-infinite medium has been developed to interpret the measured data. To test the ability of this algorithm to accurately recover the optical properties of the tissue, we made measurements in tissue simulating phantoms consisting of Liposyn concentration of 0.53% ($\mu_s' = 3.68 cm^{-1}$) in the presence of Higgins black India ink at concentrations of 0.002, 0.012 and 0.023% ($\mu_a = 0.1 – 1\ cm^{-1}$). For comparison, the optical properties of the phantom were determined independently using broad-beam illumination.
Results: We find that μ_a and μ_s' can be determined by this method with a standard (maximum) deviation of 24% (27%) and 29% (42%) for μ_a and μ_s', respectively.
Conclusion: We developed a model for quick and accurate determination of tissue optical properties in semi-infinite medium, which is theoretically suitable for determination of optical properties for esophagus PDT.