
Designing and Fabrication of a Breast Phantom for Near Infrared Source Imaging

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Abstract

Introduction: One of the prognosis in the cancerous breast tissue is variation on the breast blood vessels distribution. In this study breast phantom with vessels was designed for investigation of absorption amount of breast blood vessels after exposure to near infrared photons.

Material and Methods: The breast vessels were designed in 10 and 5 mm diameters at 35 and 15 mm deeps from upper layer of a breast phantom that called as main and minor breast vessels. Samples of water, pomegranate juice, milk; fat, oxy hemoglobin, 2 and 4 concentration of hemoglobin were injected to the main and minor vessels of the phantom. The breast phantom exposed to LED which was source of near Infrared photons and output amount was measured and calculated by spectrometer and by a powermeter.

Results: The absorption coefficient of oxy hemoglobin (normal tissue blood) was obtained $0.075 \pm 0.026 \text{ cm}^{-1}$ and $0.099 \pm 0.017 \text{ cm}^{-1}$ in main and minor vessels by spectrometer, respectively. The parameter calculated to $0.097 \pm 0.004 \text{ cm}^{-1}$ and $0.096 \pm 0.005 \text{ cm}^{-1}$ in main and minor vessels by powermeter, respectively. The absorption coefficient of blood of cancerous breast tissue (4 concentration of hemoglobin) in main and minor vessels was found $0.141 \pm 0.023 \text{ cm}^{-1}$ and $0.171 \pm 0.005 \text{ cm}^{-1}$ by spectrometer, respectively. Powermeter showed that $0.171 \pm 0.013 \text{ cm}^{-1}$ and $0.263 \pm 0.013 \text{ cm}^{-1}$ in main and minor vessels, respectively. A comparison between two kinds of photon recorder of output photons of the

phantom showed a sensitivity of 89.4% for hemoglobin of normal and cancerous but it was shown 100% by powermeter.

Conclusion: The breast phantom with vessels was useful for studying of different concentration hemoglobin. The early diagnosis of cancerous breast tissue may possible by measurement of absorption coefficient from hemoglobin concentration.

Key words: Breast cancer, absorption coefficient, spectrometer, powermeter, optical Properties