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摘要: 研究了谱域光学相干层析(SDOCT)成像系统的量化技术,通过量化OCT图像来获得生物组织内部的信息特征对组织光学散射特性进行定量分析。给出并讨论了单次散射模型,具有轴向点散射函数(PSF)的单次散射模型和多次散射模型,利用平均A-scan算法和非线性最小二乘法曲线拟合,研究不同浓度IntralipidTM溶液的散射特性。实验显示, IntralipidTM溶液的散射系数与浓度在1%~10%间基本呈线性关系,验证了具有PSF的单次散射模型比较适用于本文的谱域光学相干层析成像系统。利用该模型对小鼠的新鲜肝脏进行量化研究,得到小鼠新鲜肝脏在波长 λ_0 为1550 nm时的散射系数为 8.9 mm^{-1} 。本文的研究为该项技术今后在临床医学上对各种疾病的诊断和治疗奠定了基础。

关键词: 光学相干层析成像 生物组织 谱域 散射模型 量化

Quantitative spectral domain optical coherence tomography and its application to quantitative analysis of biological tissues

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Abstract: The quantitative analysis of spectral domain optical coherence tomography was researched to acquiring interior information of biological tissues. The single-scattering model, confocal single-scattering model and multiple-scattering model were presented and discussed. An average A-scan algorithm and a nonlinear curve-fitting method were employed to explore the scattering features of IntralipidTM. Experiments show that the relation of scattering coefficients and concentrations is linear in concentrations from 1% to 10% of IntralipidTM. Furthermore, it confirms that the confocal single-scattering model is suitable to our spectral domain optical coherence tomography. In addition, the confocal model was used to study fresh rat liver with a scattering coefficient λ_0 of 8.9 mm^{-1} at 1550 nm. Obtained results demonstrate that the quantitative spectral domain optical coherence tomography can be used for clinical diagnosis of diseases in a great potential.

Keywords: optical coherence tomography biological tissue spectral domain scattering model quantitative analysis

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