SPATIAL REFRACTIVE INDEX MODULATION OF THE RETINA ASSESSED BY HYPERSPECTRAL QUANTITATIVE PHASE MICROSCOPY

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ABSTRACT

The refractive index (RI) of the retina and its dispersion are essential parameters in ophthalmologic imaging. On one hand, the RI determines the light propagation inside the tissue towards the photoreceptors. On the other hand, its spatial distribution reflects tissue structures by biophysical properties such as density or birefringence. In this context, knowledge about wavelength dependency is crucial in high-resolution imaging, e.g., for dispersion compensation in optical coherence tomography (OCT). However, the spatial RI distribution in retinal tissue is difficult to access. We explored the capabilities of quantitative phase microscopy (QPM) for RI determination of murine retina using digital holographic microscopy (DHM) [1]. Multispectral QPM was achieved by coupling light from a tunable supercontinuum laser into a Michelson interferometer-based DHM configuration in which one of the mirrors was slightly tilted to generate digital off-axis holograms [2]. Unstained cryostat sections from mouse retina were prepared on glass carriers, embedded in phosphate buffered saline and covered with a cover slip. Digital holograms of the samples were recorded at different wavelengths in the near infrared spectral range that is highly relevant for OCT. Coherence induced noise was reduced by averaging phase maps that were acquired at different light wavelengths [3]. The tissue refractive indices that were obtained from the reconstructed quantitative DHM phase images are in well agreement with previously reported values for living cells and dissected tissues. Moreover, the detected spatial refractive index distributions correlate with results from complementary conducted OCT investigations. In summary, multispectral DHM is a promising tool for label-free characterization of optical retina properties..

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