DIFFERENTIAL PHASE POLARIZATION SENSITIVE OPTICAL COHERENCE MICROSCOPY

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ABSTRACT
Optical coherence microscopy can be applied for non-invasive optical biopsy due to utilize a high numerical aperture (NA) objective and a large spectral bandwidth low coherence laser diode which result in high spatial and axial resolutions of en face image in tissue at a given depth being extended into several hundred micrometers. Simultaneously, the heterodyne interference in OCM reduces the scattering effect in tissue too. In this research, we present a novel differential-phase polarization sensitive optical coherence microscopy (DPPS-OCM) that the en face images of the optical reflectivity, phase retardation and fast axis angle in tissue are simultaneously scanned in terms of three independent demodulated amplitudes of the heterodyne signals, Ip and Is of p and s polarization components and their differential signal ΔI=Ip-Is via a differential amplifier [1]. Because the incident p and s polarized waves are common path propagation in DPPS-OCM, the common phase noise can be removed while the differential amplifier enables to convert the differential phase of p and s waves into amplitude modulation and this enhances the detection sensitivity significantly [2]. Thus, the reflectivity, phase retardation and fast axis angle of tested medium are obtained simultaneously in terms of the amplitudes of Ip, Is and ΔI via amplitude demodulation. In order to verify the working principle of DPPS-OCM experimentally, the en face images in an electrospun scaffold which was produced by using electro-spinning method were conducted and demonstrated. Currently, DPPS-OCM focused on en face structure and collagen distribution imaging in stroma layer of a porcine cornea is proposed. The changes of those en face images in cornea will be focused for the diagnosis of cornea diseases in near future.

REFERENCES