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Title: Comparative OCT study of the efficiency of different optical clearing agents applied to the human fingernail bed area.

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WORKSHOPS: OPTICAL TECHNOLOGIES IN BIOPHYSICS & MEDICINE XXV

To increase the depth of penetration of visible and near-infrared radiation into living tissues for diagnostic reasons, numerous methods are used to ultimately increase image contrast, in particular optical cleaning which reduces the tissue scattering coefficient [1]. Optical clearing typically involves treating tissue with different agents that alter refractive index mismatches and reduce light scattering caused by variations in tissue composition and density. In this study, we explore the efficiency of various optical clearing agents (OCA) for increasing the light penetration depth and improving the visualization of subsurface structures within the nail bed using optical coherence tomography (OCT). For performing the experiments, 15 different OCA, including fructose 50%, polyethylene glycol 300, polypropylene glycol 400, omnipaque, visipaque, accupack, glycerol, cedar oil, mineral oil, oleic acid, and various combinations of these agents, are applied to the surface of the nail bed areas of healthy volunteers. Each finger is imaged using a high-resolution OCP930SR 022 OCT system (Thorlabs) with scanning laser beam wavelength 930±5 nm before and during 15 minutes of the OCA application. The results are evaluated based on the changes in the extinction coefficient calculated from the OCT scan images. Preliminary findings demonstrate that almost all OCAs used in the study have a significant impact on improving transparency and visualization of the nail bed. These agents effectively reduce scattering and refraction encountered during imaging procedures, thereby enhancing the image clarity, and enabling better access to deeper layers of the nail bed. Glycerol, for example, has the greatest potential in reducing the extinction coefficient, as compared to other OCAs. By optimizing the optical clearing techniques, we anticipate that this research allows to improve different techniques that visualize capillaries and blood perfusion, e.g., respectively digital capillaroscopy [2] and laser speckle contrast imaging [3].

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