Erythrocyte Mediated Angiography Verification with Phantom Eye

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Recent studies have shown that impaired ocular blood flow is implicated in the progression of Glaucoma, Diabetic Retinopathy, and Age-Related Macular Degeneration, three of the leading causes of blindness worldwide. To facilitate early detection of these pathologies, researchers have developed techniques for measuring ocular blood flow. One of the primary methods is erythrocyte mediated angiography (EMA). When performing EMA, blood is extracted from the patient and mixed with Indocyanine Green (ICG) to label the red blood cells by fluorescence. The ICG-labeled blood sample is reintroduced into the patient's body and a Heidelberg Retinal Tomograph (HRT) is used to capture an angiogram, where the ICG-labeled blood cells appear as brighter pixels. These cells are used to measure blood cell speed and track ocular blood flow in all patients. When imaging with HRT, the patient's native cornea is used for additional magnification; however, corneal dimensions and vessel position in the eye vary across all people. This study investigated the assumption that axial distance (AD) of the blood vessel and/or the focal length (FL) of the lens does not affect HRT images. Three FL (15mm, 18mm, 20mm) and three AD (18mm, 20mm, 22mm) were tested. For all trials, blood flow was fixed at a rate of 0.005mL/min and cell speed of 10610.33μm/s. Only trials collected at an AD of 22mm were within one standard deviation of the expected speed; however, the 15mm lens could not focus on the vessel at 22mm. Image resolution increased as AD increased, but decreased as lens FL increased. Our device was able to successfully investigate the impact of lens strength and axial distance on HRT measurements by comparing incident red blood cell speed. The application of this system has the potential to accelerate research related to the development of more accurate diagnosis and monitoring of major causes of blindness worldwide.