Photoacoustic imaging and finite element strain analysis as novel tools for assessing the roles of aqueous veins and perilimbal sclera in intraocular pressure regulation

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Abstract

We developed a photoacoustic imaging (PAI) and finite element analysis (FEA) approach for characterizing the biomechanical behaviors of the aqueous veins and perilimbal sclera, and their roles in the regulation of intraocular pressure (IOP). 3D architectures of the sclera and the aqueous veins perfused with indocyanine green have been resolved by an optical resolution PAI system. The tissue ans strain fields were quantified using FEA. The performance of the proposed method has been validated by tensile test in scleral tissue. The methods have shown the capability of resolving the strain gradients at the vein-sclera interface during the manipulation of IOP.