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Vitreous body imaging with long-range swept-source optical coherence tomography for detection of opacities

Ireneusz Grulkowski; Ana Rodriguez-Aramendia; Daniel Ruminski; Silvestre Manzanera; Yiwei Chen; Juan Mompeán; Fernando Diaz Douton; Jaume Pujol; J Sebag; Pablo Artal

— Author Affiliations & Notes

Ireneusz Grulkowski
Institute of Physics, Nicolaus Copernicus University, Torun, Poland

Ana Rodriguez-Aramendia
Instituto de Microcirugía Ocular, Barcelona, Spain
Center for Sensors, Instruments and Systems Development (CD6), Universidad Politécnica de Cataluña, Barcelona, Spain

Daniel Ruminski
Institute of Physics, Nicolaus Copernicus University, Torun, Poland

Silvestre Manzanera
Laboratorio de Óptica, Universidad de Murcia, Murcia, Spain

Yiwei Chen
Laboratorio de Óptica, Universidad de Murcia, Murcia, Spain

Juan Mompeán
Laboratorio de Óptica, Universidad de Murcia, Murcia, Spain

Fernando Diaz Douton
Center for Sensors, Instruments and Systems Development (CD6), Universidad Politécnica de Cataluña, Barcelona, Spain

Jaume Pujol
Center for Sensors, Instruments and Systems Development (CD6), Universidad Politécnica de Cataluña, Barcelona, Spain

J Sebag
VMR Institute for Vitreous Macula Retina, Huntington Beach, California, United States

Pablo Artal
Laboratorio de Óptica, Universidad de Murcia, Murcia, Spain

Footnotes

Commercial Relationships **Ireneusz Grulkowski**, None; **Ana Rodriguez-Aramendia**, None; **Daniel Ruminski**, None; **Silvestre Manzanera**, None; **Yiwei Chen**, None; **Juan Mompeán**, None; **Fernando Diaz Douton**, None; **Jaume Pujol**, None; **J Sebag**, None; **Pablo Artal**, None

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Abstract

Purpose : To perform enhanced visualization of vitreous opacities in vivo using an optimized SS-OCT instrument with tunable optics and demonstrate characteristic features of vitreous opacities by OCT imaging.

Methods : Long-range SS-OCT instrumentation was operated at the central wavelength of 1 μm and a speed of 30,000 A-scans per second. The axial range of the system enabled in vivo imaging through the entire length of the eye. OCT volumetric data sets consisting of 300x300 A-scans were acquired. Additionally, during scanning, the electrically tunable lens (ETL) changed its focal distance enabling signal enhancement at different depths of the vitreous body. A composite vitreous image was obtained as a sum of the images obtained at different focusing states, with enhanced signals from the vitreous opacities. The optical design of the interface (sample arm) was optimized to maximize the portion of the imaged vitreous. A group of healthy volunteers and patients with vitreous opacities were imaged with ultrasound and SS-OCT to visualize the vitreous body. Different contrast enhancing approaches were implemented to effectively map vitreous opacities.

Results : The performance of the prototype SS-OCT system was optimized to minimize signal drop with depth, to achieve high signal sensitivity, and to confirm scanned area. We obtained OCT tomograms spanning the depth of the entire vitreous for visualization of its scattering properties. The opacities are characterized by increased light scattering, and manifest as a hyper-intense signal behind the posterior surface of the crystalline lens or in front of the retina, or as scattering particles ('floaters') inside the vitreous body. A correspondence of OCT images ultrasound images was observed.

Conclusions : Implementation of focus tunable optics into SS-OCT enabled visualization of microstructural changes in vitreous in vivo, primarily as related to opacifications. OCT allowed for characterization of vitreous opacities and comparison of the images with ultrasound. SS-OCT can be a useful diagnostic tool in the high-resolution optical evaluation and management of vitreous opacities.

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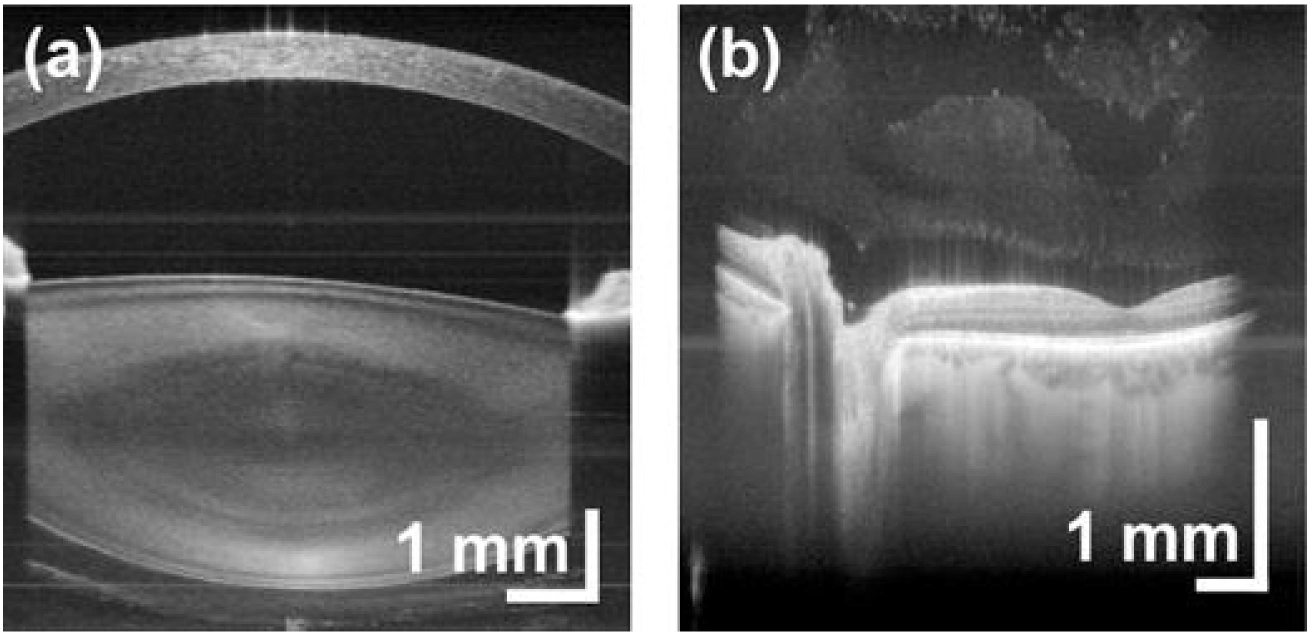

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<p style="margin: 0px;">Figure 1. OCT imaging of vitreous anterior (a) and posterior (b) interfaces.</p>