MEDICAL UNIVERSITY OF VIENNA

Christian Doppler Forschungsgesellschaft

Anatomy and physiology of the anterior eye segment

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Objective

To visualize the morphology and acquire functional parameters of the anterior eye segment (AS) using ultrahigh-resolution OCT.

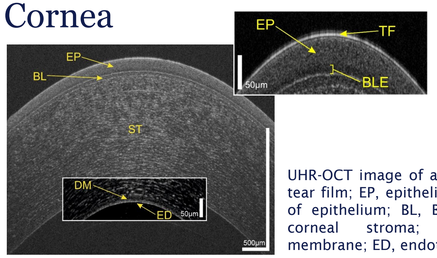
Methods

A custom-built UHR-OCT was employed for non-contact in vivo imaging [1-3].

System specifications

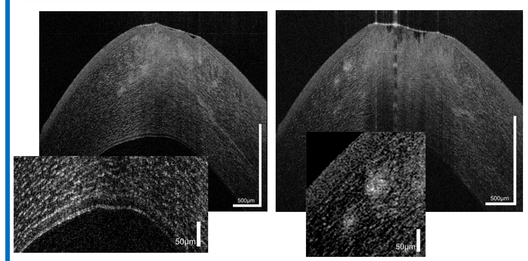
Type	SD-OCT
Detector	CMOS 4096 pixel
Acquistion rate	max 140.000 A-scans/s
Central wavelength	800 nm
Spectral bandwidth	170 nm
Axial resolution	1.3 µm in tissue
Lateral resolution	20 µm

Cornea



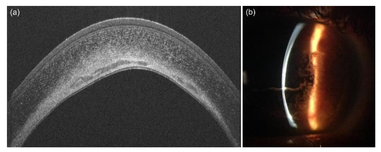
UHR-OCT image of a healthy cornea. TF, tear film; EP, epithelium; BLE, basal layer of epithelium; BL, Bowman's layer; ST, corneal stroma; DM, Descemet's membrane; ED, endothelium.

Acanthamoeba keratitis



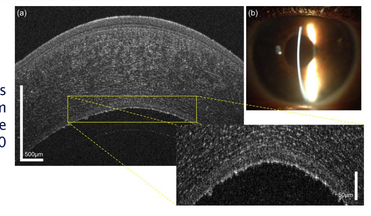
(a) Radial keratoneuritis with thickened corneal nerve and morphological changes in the DM-endothelial complex. (b) Defects in epithelium and anterior stroma and at least three Acanthamoeba cysts visible in UHR-OCT.

Herpetic keratitis



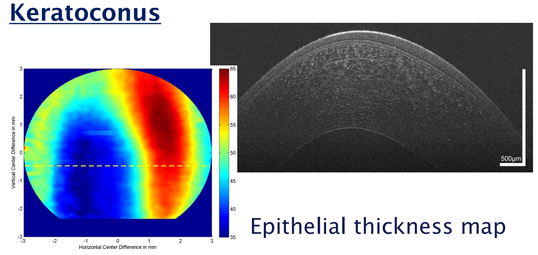
Corneal neovascularization and calcifications/lipids in the anterior stroma in a 34 year old male patient.

Fuchs endothelial dystrophy



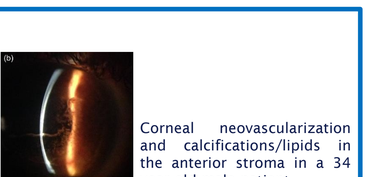
UHR-OCT imaging reveals guttatae in the endothelium and thickening of the Descemet membrane in a 60 year old female patient.

Keratoconus

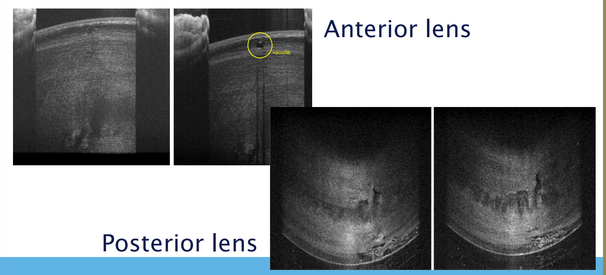


Epithelial thickness map

Crystalline lens



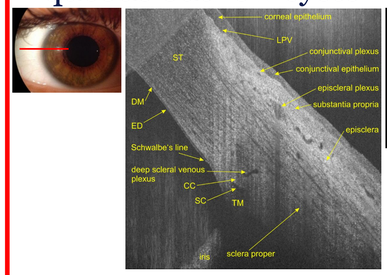
Cataract

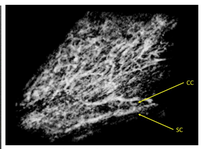


Anterior lens

Posterior lens

Aqueous outflow system

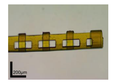


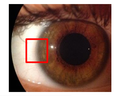


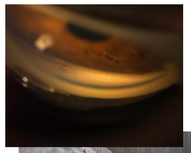
TM, trabecular meshwork; SC, Schlemm's canal; CC, collector channel; LPV, limbal palisades of Vogt; ED, corneal endothelium;DM, Descemet's membrane; ST, corneal stroma; TF, tear film.

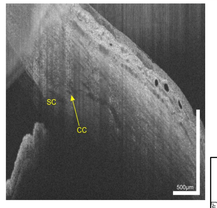
MIGS devices in glaucoma patients

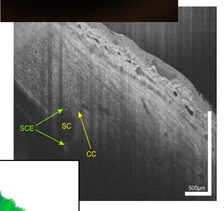
Stegmann canal expander

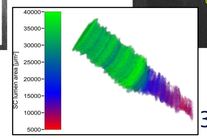






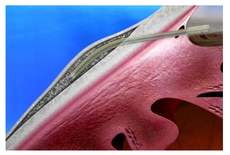


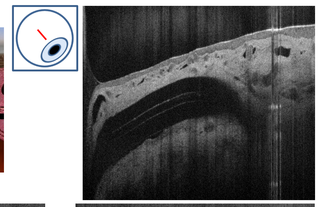


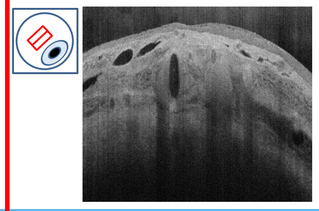


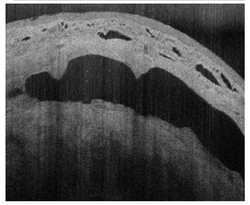
3D segmentation

XEN Gel Stent





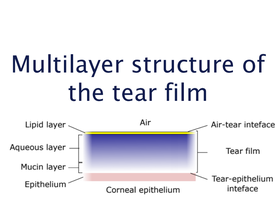


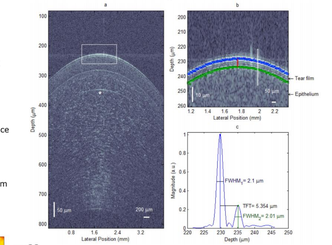


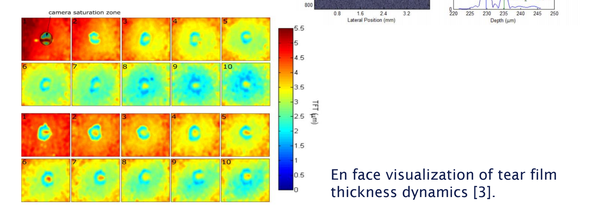
Precorneal tear film

Tear film thickness & tear film dynamics

Multilayer structure of the tear film

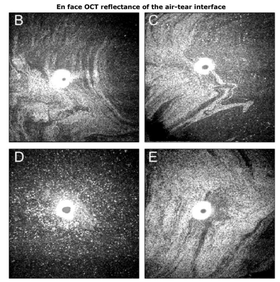






En face visualization of tear film thickness dynamics [3].

Tear film lipid layer



En face lipid layer patterns [3].

Conclusion

UHR-OCT

1. Provides visualization of AS morphology and function with remarkable 3D detail
2. Helps with fast and acurate diagnosis of ocular pathologies
3. Provides objective markers for comparison of healthy and diseased eyes
4. Can be a helpful tool in planning of surgical interventions, treatment monitoring and post-op managment

References

[1] Werkmeister et al., *Biomed Opt Express 2017*
[2] Aranha dos Santos et al., *Biomed Opt Express 2015*
[3] Aranha dos Santos et al., *Biomed Opt Express 2016*