Conclusion The usefulness of AI for annotating corneal OCT lesions depends on the homogeneity and quality of the image. OCT systems which provide higher resolution images enable better automated annotation.

OP-4 DEVELOPMENT OF NOVEL HUMAN-DERIVED HYBRID HOST DEFENSE PEPTIDES FOR INFECTIOUS KERATITIS

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Background/Aim Infectious keratitis (IK) is a major cause of corneal blindness worldwide. This study aimed to develop potent human-derived hybrid host defense peptides (HyHDPs) with broad-spectrum antimicrobial activities for IK.

Methods HyHDPs were rationally designed through combination of human cathelicidin (LL-37) and human-beta-defensins (HBDs), and with guidance from molecular dynamics (MD) simulations. Efficacy of HyHDPs was determined against a range of bacteria, fungi and Acanthamoeba. Risk of antimicrobial resistance (AMR) was evaluated using multipassage AMR assay. Pre-clinical murine studies were performed to examine the in vivo efficacy and safety of HyHDPs in methicillin-resistant S. aureus (MRSA)-related keratitis.

Results Hybridisation of LL-37 and HBD-2 led to the development of HDP23, which demonstrated good efficacy against S. aureus and MRSA [minimum inhibitory concentration (MIC)=12.5–25.0 μm/ml], but not against fungi or Acanthamoeba. MD simulations provided atomistic insights into the key membrane-active residues and accelerated the discovery of HDP56. Compared to HDP23, HDP56 exhibited 4–32 times improved efficacy against S. aureus, MRSA, Pseudomonas aeruginosa, and Fusarium solani (MIC=3.1–6.3 μm/ml). At 100 μm/ml, HDP56 exhibited good anti-Acanthamoeba trophozoites efficacy (99.8%) and anti-encystation efficacy (80.9%). S. aureus did not develop any AMR against HDP56 after 15 treatment passages/days but developed significant AMR (32 times increase in MIC) against levofloxacin after 13 passages/days. Pre-clinical murine studies demonstrated strong efficacy and safety of HDP56 (0.5 mg/ml) in treating MRSA-related keratitis (93% reduction in bacteria, which was equally effective to levofloxacin (5 mg/ml).

Conclusion Rational hybridisation of HDPs, with guidance from MD simulations, has enabled the development of a novel HDP-based therapy for IK.

OP-5 MEASURING BOWMAN'S LAYER IN THE CLINIC

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Purpose To assess the accuracy, repeatability, and performance limits of in vivo Mirau ultrahigh axial resolution (UHR) line field spectral domain (LF-SD) optical coherence tomography (OCT) for the clinical in vivo measurement of Bowman's layer thickness in subjects with and without keratoconus.

Methods Patients with keratoconus and volunteers with no corneal disease were included. The thickness of Bowman's layer was measured in the clinic. An in vivo graph search image segmentation of the central cornea was obtained at the normal interface vector orientation. The Mirau-UHR-LF-SD-OCT system used has an axial resolution down to 2.4 μm in air (1.7 μm in tissue), with an A-scan speed of 204.8 kHz and a signal to noise ratio (sensitivity) of 69 (83) dB.

Results 40 patients with keratoconus and 20 healthy volunteers were included. The repeatability of mean Bowman's and epithelial thicknesses were 0.3 and 1.0 μm, respectively. The measured 95% population range for Bowman's layer thickness was 13.7 to 19.6 μm for healthy (mean 16.65, SD 1.48) and 10.94 to 16.99 for 23 of the keratoconics (mean 13.96 SD 1.51) ($p<0.05$).

Conclusions The measured thicknesses of Bowman's layer using the Mirau-UHR-LF-SD-OCT were both accurate, with the range for healthy in vivo thicknesses matching prior confocal and OCT systems of varying axial resolutions and repeatable. Bowman's layer was significantly thinner in patients with keratoconus. Bowman's layer can be accurately measured in the clinical setting using a Mirau-UHR-LF-SD-OCT and can be useful for disease monitoring.

OP-6 SIMULATED LAMELLAR AND ENDOTHELIAL KERATOPLASTY USING THREE-DIMENSIONAL PRINTED AND THIN-FILM MODELS

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Background Corneal transplantation techniques' evolution has resulted in faster visual recovery, lower immunological rejection, and improved graft survival. However, the number of transplants that can be performed can be limited by a lack of donor corneas, a steep learning curve, and the need for specialised expertise.

Methods A literature search was undertaken of Ovid/MEDLINE and PubMed/EMBASE to review current corneal surgery simulation models and best-practice lamellar and endothelial keratoplasty techniques. A DALK simulation model was designed using Fusion 360 (Autodesk, San Rafael, California, USA) and printed with the J850 (Stratasys, Eden Prairie, Minneapolis, USA). A DMEK simulation model was created using thin films to allow the practice of the intraocular DMEK unfolding manoeuvres.

Results The DALK simulation model was produced with a shore hardness A value consistent with the mammalian cornea. Dimensions of the simulation models were based on the emmetropic model eye. Experienced corneal surgeons performed simulated surgery on the models and evaluated face and content validity.

Conclusion 3D printed and thin film models have practical benefits compared with cadaveric models; they do not decompose and can be standardised to model specific surgical scenarios. 3D printing is an innovative technology with applications across many fields, including healthcare. It allows for the