Abstracts

**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 meticillin-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 μg/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 μg/ml). At 100 μg/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.
creation of customised simulation models for cornea surgical practice with a short lead time and reduced waste.

**OP-7**

**PREDICTING CORNEAL OEDema FROM SCHEIMPFLUG IMAGES OF FUCHS’ ENDOTHELIAL CORNEAL DYSTROPHY (FECD)**

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**Introduction** We previously developed a model to predict improvement in central corneal thickness (CCT) after Descemet’s membrane endothelial keratoplasty (DMEK) for FECD from Scheimpflug images. The model incorporated parameters of pachymetry map isopach regularity and posterior corneal radius. In this study we assessed if adding corneal backscatter and pachymetric progression indices improved the predictive power of the existing model.

**Methods** The additional 37 parameters of interest were exported from the Scheimpflug camera software for images of eyes undergoing DMEK and were combined with all previous 180 parameters originally considered for the predictive model. Gradient boosting machine (GBM) models were used to determine the 5 parameters with highest relative influence. A regression model was derived from the 5 highest relative influencers and goodness-of-fit of predicted vs. observed improvement in CCT was assessed in derivation and validation groups.

**Results** Anterior and mid-corneal backscatter were high influencers along with isopach regularity parameters whereas pachymetric progression indices were not. After incorporating corneal backscatter, the predictive power (from R2) of the model in the derivation group was 79% (n=48). When the derivation model coefficients were applied to the validation group, the predictive power in the validation group was 72% (n=45).

**Conclusions** Combining anterior and mid-corneal backscatter with isopach regularity parameters creates a strong predictive model of CCT improvement after DMEK. However, the predictive power of this model did not improve the predictive power of the original model (derivation group, 80%; validation group, 78%). The predictive model could provide important ancillary test information to help inform clinical decision-making for FECD.

**OP-8**

**ABSTRACT WITHDRAWN**