

NCC 'Beyond 2020' Paper Abstracts  
Free paper sessions  
Sunday, March 15, 2020 16:30 – 17:30  
Netherlands, Veldhoven, de Koningshof,  
Diezezaal

**Organization Section:** NCC/ BCLA  
**Moderator:** Claire McDonnell

**Paper Number:** 11

**Presentation time:** 16:30-16:37

**A starting point for scleral lens fitting:  
corneal sagittal height measured with  
OCT and Scheimpflug CSP software in  
keratoconic and healthy eyes**

*Kirsten Carter, Luigina Sorbara*

**Purpose:** The purpose of this study was to compare the sagittal depth of the initial trial scleral lens predicted by two instruments in eyes with and without keratoconus (KC). A secondary objective was to compare corneal sagittal height between groups. It was hypothesized that initial lens prediction would be similar between instruments, and corneal sagittal height would be different between groups.

**Method:** Thirteen participants with KC and 10 without were recruited for this cross-sectional case-control study. Horizontal and vertical sagittal heights were measured with Visante™ OCT (Zeiss Meditec, Dublin, CA) at 15mm, and averaged. With Oculus Pentacam HR® CSP, sagittal heights given at 15mm were averaged. To predict sagittal depth of the initial trial lens, 400µm was added to Visante average sagittal heights (as per previous work), and 300µm to Pentacam measurements as per manufacturer's recommendation.

**Results:** For the control group, predicted initial lens sagittal depth with OCT and Pentacam were not statistically significantly different ( $P = 0.3326$ ). There was a statistically significant difference in the KC group ( $P = 0.0002$ ), with OCT estimating on average a higher sagittal depth. There were statistically significant differences between groups for corneal sagittal height assuming equal variances (OCT:  $P=0.0417$ , Pentacam:  $P=0.017$ ) but

measures were not significantly different for Pentacam assuming unequal variances ( $P=0.5242$ ). Bland-Altman analysis showed a systematic error comparing the two devices for the KC group: at lower corneal sagittal height values, OCT underestimated the sag and at higher values, OCT overestimated the sag.

**Conclusions:** For eyes without KC, measurements taken of CL sagittal depth with two different instruments yield highly congruent results. Although a statistically significant difference was noted between instruments for eyes with KC, averages were not clinically significantly different. Although the KC group had a higher clinically significant sag compared to the control, our small sample size did not show statistical significance.

**Research funding received:** Bausch & Lomb Optical Independent Research Grant. No commercial relationships.

**Paper Number:** 12

**Presentation time:** 16:37-16:44

**From vision to ocular surface  
rehabilitation, a paradigm shift in scleral  
contact lens prescribing**

*Boris Severinsky, Jenya Davelman*

**Purpose:** The aim of this study was to evaluate the penetration rate of therapeutic scleral contact lenses into the contemporary cornea and ocular surface disease practice and to determine what ocular inflammatory conditions have the best success rate with scleral lens therapy  
**Method:** Retrospective chart review of 183 consecutive patients fitted with scleral contact lenses at the Ophthalmology Department of Emory University from April 2018 to March 2019. We evaluated the fitting indications, time required for the ocular surface stabilization and the vision rehabilitation success.

**Results:** This study included 281 eyes of 183 patients. Among them, 94 eyes (33.5 %) were fitted for the management of the ocular surface disease. Main surface conditions were Keratoconjunctivitis Sicca

(KS) of autoimmune etiology 38 eyes (including 12 eyes with confirmed Sjogren's syndrome), Ocular Graft-Versus-Host Disease (GVHD) 18 eyes, Neurotrophic Keratitis (NK) 15 eyes, Ocular Cicatricial Pemphigoid (OCP) 11 eyes, Stevens-Johnson syndrome (SJS) 6 eyes and 2 eyes after corneal neurotization procedure. The rest of the patients were fitted for irregular cornea vision rehabilitation. 88% of eyes fitted for ocular surface-related indications responded well to therapy and continued scleral lens wear. The highest success rates were recorded in GVHD (86%), OCP (98%) and NK (84%) groups. The mean visual acuity among surface disease patients improved from 20/80 to 20/30 scleral lens corrected (range, 20/400 to 20/20). Over 25% of referrals were from non-ophthalmology providers.

**Conclusions:** this study shows higher, than previously reported in the literature, the rate of therapeutic scleral lens use for ocular surface disease management. Referral to scleral lens fitting is not limited to ophthalmology. Other medical professions have an increased awareness of scleral lens therapeutic benefits. This allows timely referrals and might save sight in many cases.

**Research funding received:** N/A

**Paper Number:** 13

**Presentation time:** 16:44-16:51  
**Effects of different post lens saline filling solutions on midday fogging in habitual scleral lens wearers.**

*Giancarlo Montani*

**Purpose:** The aim was to evaluate the effect of different post-lens saline filling solutions used during scleral lens wear on objective quality of vision (OQV) and ocular straylight (OS) in subjects with midday fogging.

**Method:** We selected 12 eyes with keratoconus and 6 eyes with post graft (PG) with no corneal opacities and with visual symptoms after several hours of lens wear. OQV was evaluated considering the MTF cut off, Strehl ratio

(SR) and objective scatter index (OSI) measured using a double pass instrument. OS was evaluated using the compensation comparison method. All measurements were repeated after 6 hours of wear with the lens in place one day using a common unpreserved saline (US) and the second one using an US with electrolytes K+, Ca++, Mg++ (US+E) as filling solutions. The baseline values were obtained the first day after the lenses were removed and reinserted with fresh US.

**Results:** The baseline values for MTF cut off, SR, OSI and OS for eyes with keratoconus and PG were respectively (mean±SD) 24.80±5.51c/deg, 0.16±0.03, 1.50±0.39, 1.12±0.13log(s) and 23.98±8.90c/deg, 0.17±0.05, 1.46±0.07, 1.17±0.23log(s). In eyes with keratoconus the MTF cut off, SR, OSI and OS comparison with baseline were not significant different (p>0,05) when US+E was used (23.03±5.84c/deg, 0.14±0.03, 1.73±0.61, 1.18±0.09log(s)) while were significant different (p<0,05) when US was used (17.61±7.44c/deg, 0.10±0.03, 2.50±1.14, 1.46±0.29log(s)). Similar results were found in eyes with PG where MTF cut off, OSI and OS comparison with baseline were not significant different when US+E was used (22.61±8.96c/deg, 1.70±0.83, 1.29±0.21log(s)) while were significant different when US was used (11.43±5.52c/deg, 2.88±1.02, 1.58±0.17log(s)). Just SR was significant different for both solutions (US+E 0.14±0.05 and US 0.11±0.08).

**Conclusions:** In conclusion, the decrease of quality of vision with midday fogging during the scleral lens wear can be improved using as a filling solution, an US with balanced essential electrolytes.

**Research funding received:** N/A

**Paper Number:** 14

**Presentation time:** 16:51-16:58

**Biomechanical corneal characteristics impact IOP measurement in a Keratoconus population**

*Langis Michaud, Gilles Amblard*

**Purpose:** This study aims to compare IOP

measurement assessed by Ocular Response Analyzer (ORA), taking in account the biomechanical characteristics of the cornea, vs the standard Goldmann tonometry, in a population of keratoconus patients, and to evaluate the impact of cross-linking on these findings.

**Method:** This is a prospective, randomized, non-masked study, involving a single visit. Participants, already diagnosed with keratoconus, were recruited from those consulting at Clinique Universitaire de la Vision (U de Montreal). The first 40 participants meeting the inclusion criteria were enrolled. They were asked to remove contact lenses 1h00 prior assessment. Clinical testing began with Scheimpflug topography (Sim K, steepest K, pachymetry, anterior chamber volume and Irido-corneal angle). Then a drop of proparacaine 0.5% was instilled, followed with 2 drops of fluoresceine, put 1 minute apart. IOP measurement, equivalent to Goldmann (g) or compensated for biomechanical properties of the cornea (CC) (ORA, Reichert, US) and IOP Goldman tonometry (G) were taken in that order for every patient. A slit lamp examination was done at the end to make sure that ocular health remained unaltered by the procedures. Statistical analysis was run considering just one eye per participant, randomly selected. Anova for repeated measured was conducted to analyse IOPg, IOP cc and Goldman tonometry results. A Bland-Altman analysis was also conducted to compare these 3 measurements. Finally, Pearson correlation was established between corneal biomechanical parameters and IOP values.

**Results:** Twenty-eight eyes (non cross-linked) and nine cross-linked eyes were considered for analysis. There was a high inter-variability among subjects. For KC participants, non cross-linked (CXL), G was found significantly higher from g (11.0 vs 9.1,  $p=0.032$ ) and lower than CC (11.0 vs 12.8,  $p<0.01$ ). Corneal hysteresis (CH=8.3) and Resistance Factor (CRF = 6.7) were

found lower than a normal population. Corneal thickness was 444.5  $\mu\text{m}$  in average, with anterior chamber volume of 185  $\text{mm}^3$ . Angle was open (40.3 deg). For those treated with CXL, G and g are considered not significantly different (11.0 vs 10.5,  $p>0.05$ ) while G and CC were still found different (11.0 vs 13.9,  $p<0.01$ ). CRF is correlated with IOP, but not CH. Corneal thickness, and angle parameters are similar to non CXL group, and not correlated with any IOP.

**Conclusions:** If corneal biomechanical parameters are taken in account, Goldmann tonometry underestimates the real value of IOP. This may be also due to the lower central corneal thickness in keratoconus. Cross-linking seems to change this perspective: IOP G and from ORA (g) are found interchangeable and similar. These results highlight the importance of assessment methods in irregular cornea patients.

**Research funding received:** None

**Paper Number:** 15

**Presentation time:** 16:58-17:05

**Effects of contact lens wear on corneal tomography of posterior surface in patients with keratoconus**

*Shizuka Koh, Ryota Inoue, Naoyuki Maeda, Kazuichi Maruyama, Kohji Nishida*

**Purpose:** Rigid gas-permeable contact lenses (RGP-CLs) are most frequently used for the non-surgical correction of irregular corneal astigmatism in patients with keratoconus (KC). This study investigated the changes in the posterior corneal surface associated with the wearing of spherical RGP-CLs with apical-touch fitting.

**Method:** Forty-one eyes of thirty-two patients with KC who wore spherical RGP-CLs with apical-touch fitting continuously, without presenting any complications, were enrolled in this prospective study. Corneal topographic data were obtained with a three-dimensional anterior segment optical coherence tomography (OCT) with and without RGP-CLs. Dioptric data from the central 3-mm zone of the

posterior corneal surface were decomposed into spherical component, regular astigmatism, and irregular astigmatism (asymmetry and higher-order irregularity) using Fourier harmonic analysis.

**Results:** Both spherical and regular astigmatism values were significantly higher without RGP-CLs ( $-7.04 \pm 0.88$  D and  $0.44 \pm 0.88$  D, respectively) than that with the use of RGP-CLs ( $-6.69 \pm 0.59$  D and  $0.32 \pm 0.18$  D, respectively;  $p < 0.01$  for both). The measured values of asymmetry with the wearing of RGP-CLs ( $0.79 \pm 0.45$  D) were significantly smaller than those obtained without the wearing of RGP-CLs ( $1.00 \pm 0.52$  D;  $p < 0.01$ ); the measured values of higher-order irregularities were significantly greater with RGP-CLs ( $0.15 \pm 0.16$  D) compared with that without RGP-CLs ( $0.11 \pm 0.08$  D;  $p < 0.01$ ).

**Conclusions:** Quantitative Fourier analysis of corneal astigmatism in the posterior corneal surface in patients with KC showed that the wearing of RGP-CLs with apical-touch fitting corrects posterior corneal regular/irregular astigmatism. It is well known that RGP-CLs reduce corneal astigmatism in the anterior corneal surface. However, the effect of RGP-CL use on the posterior surface has not yet been evaluated. We believe this is the first study to quantify changes in astigmatism in the posterior surface.

**Research funding received:** A research grant from SEED Co., LTD.

**Paper Number:** 16

**Presentation time:** 17:05-17:12

**Comparative Analysis of Tear Protein in Keratoconic Scleral Lens wearers with varying limbal clearance.**

*Debby Yeung, Paul J Murphy, Luigina Sorbara*

**Purpose:** The purpose of this study is to investigate changes in levels of inflammatory mediators in the tear film of keratoconic scleral lens wearers with varying limbal clearance (LC) designs.

**Method:** Eleven keratoconic participants completed the study according to the

Tenets of Helsinki and with written consent. Each individual was fitted with two sets of scleral lenses that had the same diameter, central sagittal depth, but varied in LC by  $50 \mu\text{m}$ . Lenses were worn in a randomly assigned order for a two-week period. At each follow-up visit, immediately after lens removal, tears were collected with a microcapillary tube ( $10 \mu\text{L}$ ,  $0.5 \text{mm}$  in diameter) from the pool of tears in the bowl of the inverted scleral lens. Tear cytokine and protease analysis was performed using a multiplex electro-chemi-luminescent array (Meso Scale Discovery, Rockville, MD) instrument. Levels of IL-1, -6, -8, TNF- $\alpha$ , MMP-1 and -9 were compared using a Student t-test statistical analysis.

**Results:** The median volume collected from the post-lens tear film (lens bowl) was  $5.0 \mu\text{L}$  (Range  $0.2$  to  $10.0 \mu\text{L}$ ). Significant differences at the  $p < 0.05$  levels were found comparing low and high LC with IL-1 $\beta$ , TNF- $\alpha$  and MMP-1 from the samples taken from the lens bowl. Scleral lenses with high LC resulted in increased levels of IL-1 $\beta$ , TNF- $\alpha$  and MMP-1.

**Conclusions:** Changes in the cytokine levels were found comparing low and high LC indicating that mid-peripheral lens fit is an important feature in regulating the inflammatory response of the keratoconic eye.

**Research funding received:** Unrestricted grant from Bausch + Lomb

**Paper Number:** 17

**Presentation time:** 17:12-17:19

**Which daily disposable soft lens works best in a reverse piggyback system?**

*Claire McDonnell, Emma Chaney, Aoife Farrell, Tara Kennedy*

**Purpose:** The aim of this pilot study was to determine which of four different daily disposable contact lenses would be the best lens to use in a reverse piggyback (soft lens worn over RGP lens) system.

**Method:** 12 subjects (24 eyes) who could tolerate RGP lens wear without anaesthetic had four different contact lenses placed on top of their RGP lenses

consecutively. The lenses tested were etafilcon A, senofilcon A, delefilcon A and omafilcon A. This was a double-blind, randomized study. Baseline measurements of comfort (using a visual analogue scale), best corrected visual acuity (BCVA) and over refraction were taken with just the corneal RGP lenses in place. The same measurements were repeated with each of the four soft lenses placed on top of the RGP lens. The difference in the measurements between baseline and with each of the four lenses in place were statistically analysed.

**Results:** There was a statistically significant difference in comfort ranking as determined by a Friedman analysis which gave a chi squared result of 9.0136 (3, N=22),  $p = 0.02911$ . However, there was no clinically significant difference in comfort ranking. One-way ANOVA testing showed no statistically significant differences at the  $p < 0.05$  level between the four soft lenses for either BCVA [ $F(3,90) = 0.226$ ,  $p = 0.88$ ] or over refraction [ $F(3,84) = 0.304$ ,  $p = 0.82$ ].

**Conclusions:** Any of the four soft contact lenses tested could be used in a reverse piggyback system but the chosen lens must be properly evaluated within the system, as the soft lenses can have a negative effect on RGP lens centration and thus stability of VA. Lenses may cause a reduction in BCVA of up to three lines on a logMAR chart.

**Research funding received:** None

**Paper Number:** 18

**Presentation time:** 17:19-17:26

**Validation of the online fitting app OptiExpert for a reusable multifocal soft contact lens**

*Gary Orsborn, Jill Woods, Jalaiah Varikooty, Amanda Bogers*

**Purpose:** The multifocal soft lens calculator within the OptiExpert™ app was developed by CooperVision, Inc. to make multifocal contact lens fitting simpler and more efficient. Comparisons between clinician-dispensed lens prescription and

app-recommendation were conducted to validate the software.

**Method:** Fifty-five subjects were fit and dispensed with comfilcon A multifocal lenses (MF; CooperVision, Inc) according to the manufacturer's fitting guide. Lenses were optimised after 3-10 days to determine the final dispensed lens power (Dispensed-Rx). Afterwards, the subjects' refraction data (sphere, cylinder, add, ocular dominance) were entered into the OptiExpert app. The app-recommended power (OptiExpert-Rx) was compared to the Dispensed-Rx using limit of agreement (LOA) and correlation analyses.

**Results:** The 110 eyes spanned refractions from +1.25 to -3.25DS with  $\leq -1.00$ DC, and reading-additions from +1.25 to +2.50D. After optimised fittings, 71% subjects achieved the final Dispensed-Rx with just one pair of trial-lenses, 98% required two pairs. Comparing Dispensed-Rx to OptiExpert-Rx: the sphere mean difference was +0.03DS (95% LOA: -0.36 to +0.43); they exactly matched for 63% eyes and were within 0.25DS for 94% eyes; significant correlation:  $r = 0.989$ ;  $p < 0.0001$ . For reading addition power, the mean difference was -0.03DS (95% LOA: -0.72 to +0.67); exactly matched for 60% eyes and were within 0.50DS (1-step) for 96% eyes; significant correlation:  $r = 0.656$ ;  $p < 0.0001$ . For the distance/near-centre design allocation, OptiExpert-Rx was identical to Dispensed-Rx for 69% subjects, different for one eye in 15 subjects, two eyes in two.

**Conclusions:** The lens parameters recommended by the OptiExpert app were all in close agreement with the final dispensed lens fit using the fitting guide, and exactly matched for most. Given this high level of agreement, the OptiExpert multifocal soft lens calculator can be used as a clinical tool to aid CooperVision MF fitting success, and may save valuable patient chair time by recommending appropriate initial trial lenses.

**Research funding received:** Study sponsored by Cooper Vision

**End of session**