COPE Outline
GSLS 2023 Rapid Fire Poster Presentation Session

The authors of ten posters have been selected to present a summary of their work as a 5-minute General Session Lecture. The participants will…1, present their poster at the GSLS Poster Exhibit. 2, provide a 5-minute General Session Lecture introducing and summering their poster, 3, each presenter will be limited to presenting 5 slides *only* throughout their 5-minute lecture. The speakers and topics for this session include…

Rapid Fire Poster 1: Real World Perspective of Orthokeratology Efficacy and Patient Adherence - Three-Year Retrospective Assessment

Kevin Chan, OD, MS

1) Purpose
   a) To evaluate patients' perspective and clinical efficacy and patients' adherence of orthokeratology in a real-world practical setting based on a 3-year retrospective analysis
2) Methods
   a) A total of 342 children with myopia were referred, treated, and followed up in a myopia-dedicated practice over a three-year period.
   b) Children in this retrospective study were managed using various treatment options, specifically orthokeratology (Ortho-K), soft multifocal contact lenses (SMFCL), as well as atropine (ATR). In some cases, a combination of these three with a global cost of each to minimize cost bias.
3) Results
   a) During the 3-year retrospective review, orthokeratology stood out as the most prescribed modality for the overall population (55% of the total population, or 188 of 342 children). The majority (84%) of all patients monitored in the study were prescribed with Euclid orthokeratology lenses, in which 78% of the patients who were treated with ortho-k lenses and completed 3 years of follow up visits revealed a 0.25 diopter or less reduction of myopia progression. In contrast, only 68% of patients in multifocal soft contact lenses (SMFCL), and 22% of patients prescribed atropine alone did not require any changes in treatment.
   b) This demonstrates higher retention and adherence to treatment proven with Euclid orthokeratology lenses versus other treatments.
   c) Moreover, the Cumulative Absolute Reduction in axial Elongation (CARE) values for the three main treatment types were also determined.
      i) CARE represents an empirically demonstrated, evidence-based articulation of myopia control effect over time. Comparing with the age- and ethnicity-matched virtual control group, CARE showed a cumulative of 0.32mm over 3 years in the orthok-only group, 0.20mm in the SMFCL-only group in 2 years, and 0.23mm in the atropine-only group in 3 years, respectively.
4) Conclusion

a) Within the population of patients treated and managed during the three-year period, orthokeratology showed remarkable and sustainable efficacy and patients' adherence, as compared to soft multifocal contact lenses and atropine in various concentrations, for managing myopic progression for children.
b) In particular, the efficacy of orthokeratology was evidently substantiated by a reduction in both refractive error progression and, more importantly, axial length elongation. When prescribed and monitored carefully, orthokeratology can be a reliable and life-changing treatment regimen for myopia management.

Rapid Fire Poster 2: The IT Factor of Scleral Lens Fitting: A Scleral Shape Study

Amrit Singh

1) Purpose
   a) Scleral lens fitting can be challenging due to issues at the edge. Patients may show blanching or edge lift at the landing zone depending on the shape of the lens in relation to the patient's sclera. Many studies have shown the significant irregularity of the sclera, usually increasing farther from the limbus.
   b) This study was meant to investigate the shape of each quadrant of the sclera and compare them at various chord lengths. Research has shown there to be steeper scleral slope in the inferior temporal (IT) quadrant which may explain why scleral lenses decenter in that direction. The amount of elevation in this quadrant may suggest the need for a more quadrant specific edge design with initial scleral lens fitting.
2) Methods
   a) The Pentacam was used to measure a CSP report on 25 patients, 50 eyes. Five scans were taken of each eye to ensure that at least 17mm of data was captured. The sagittal depth and bulbar slope were measured at 15.5, 16, 16.5, and 17mm chords and data was analyzed in each quadrant. Quadrants were assigned as 1 corresponding to 1 to 90°, 2 corresponding to 91 to 180°, 3 corresponding to 181 to 270°, and quadrant 4 corresponding to 271 to 0/360°. The data collected were then analyzed by quadrant and by rank of depth.
3) Results
   a) Averages of each quadrant, of each eye, showed the IT region, quadrant 3 OD and quadrant 4 OS, to be significantly steeper in bulbar slope and deeper in sagittal depth than the other quadrants. Average bulbar slope was 44.08° OD and 43.16° OS while the next steepest quadrants were 39.12° and 39.04° respectively. This was a significant difference in slope which also translated to a significant difference in elevation with the IT quadrant. The average sagittal difference between the IT quadrant and the next deepest was 244 microns OD and 210 microns OS which was significantly deeper than the other quadrants.
4) Conclusion
   a) The data from this study suggests the IT quadrant to be significantly steeper and deeper than other quadrants of sclera. Other studies have demonstrated asymmetry in scleral shape, but this data adds to what has already been shown. Regarding this information, it shows that quadrant specific edge design should be considered when fitting scleral lenses.

b) Previously, these designs have been used more as customization and troubleshooting, but quadrant specific trials designed to account for the 200-micron difference in the IT region may result in better edge alignment and centration.

Rapid Fire Poster 3: Enhancing initial SCL fitting success utilizing sagittal depth sagittal depth

Mari Fujimoto, OD

1) Purpose
   a) Soft contact lens (SCL) fitting based on overall sagittal depth (SAG) may provide more concrete decision-making compared to using lens base curve (BC) and diameter (DIA). Currently, there is minimal evidence in the literature that highlights the amount of SCL SAG necessary to fit varying ocular sagittal depths (OC-SAG). This pilot study aimed to evaluate the change in SCL SAG necessary to provide an appropriate initial lens fit and which anatomical features can provide a good idea of sagittal depth.
2) Methods
   a) Three subjects with a visible iris diameter (VID) of 11.8 mm trialed six, SiHy material, lathe-cut, custom manufactured SCLs for 10 minutes of wear.
   b) The 6 lenses were -3.00DS and 14.2 mm in DIA and the SCL SAGs ranged from 3400 to 4400 in 200-micron increments, achieved by steepening the lens BC.
   c) The ocular sagittal depth (OC-SAG) were measured with the Zeiss Cirrus OCT and the central K's and corneal eccentricity were measured with the Medmont Meridia. T
   d) he fit was assessed by video recording on the Medmont Meridia and lens decentration, lens movement in primary gaze and upgaze, and subjective comfort were used to determine the appropriate SCL fit.
3) Results
   a) Despite all having an 11.8 mm VID, the subjects had ocular sagittal depths of 3381, 3522, and 3651 microns.
   b) When deemed an appropriate fitting lens by the examiner, the average difference between SCL SAG and OC SAG was 282 microns (range 219 – 349). For most subjects, the corneal angle measured at about a 12.8 mm chord predicted the OC-SAG most accurately.
   c) Additionally, assessing the flat K-value combined with the corneal eccentricity provided a fairly accurate prediction of the OC-SAG.
4) Conclusion
   a) The results show that SCL fitting requires a CL SAG of at least 282 microns deeper than the OC SAG to optimize the SCL to ocular surface fitting relationship in lathe-cut, SiHy material SCLs.
   b) The SAG fitting factor of 282 microns may vary depending on the manufacturing method of the SCL, the modulus, and lens thickness.
   c) Matching the SCL SAG to the OC SAG provided a lens fit that is too shallow, with lens decentration and inadequate limbal coverage.
   d) Lenses that were 282 microns or greater than the OC SAG provided an adequate fit upon observation, but future studies should evaluate how much CL SAG is excessive, resulting in symptoms of end-of-day tightness.

Rapid Fire Poster 4: The Impact of Rigid Gas Permeable Care Solutions on Lens Parameters, and Lysozyme Deposition on RGP Lenses when Disinfected with a Hydrogen Peroxide Care solution

Alex Hui, OD, PhD

1) Purpose
   a) To investigate the impact of rigid gas permeable (RGP) care solutions on lens parameters of contemporary RGP contact lens (CL) materials according to the ISO 11981:2017 standard, and the ability of a hydrogen peroxide based RGP solution to remove protein from various RGP lens materials.
2) Methods
   a) Lens curvature, back vertex power, physical appearance and spectral transmittance were initially measured on roflufocon E, paflufocon B, pasifocon A, paflufocon D, hexafocon A, oprifocon A and hexafocon B RGP lenses soaked for 24 hours in phosphate buffered saline (PBS), in accordance with ISO methods. Lenses were then subjected to 30-31 soaking cycles, alternating between 16 hours in PBS and 8 hours in one of two commercially available CL care products based on 3% hydrogen peroxide. The lens parameters were then remeasured, and deviations were evaluated against the tolerances specified in the ISO standard.
   b) Total lysozyme deposition on lenses over alternating cycles of soaking in an artificial tear solution containing radiolabeled lysozyme and cleaning using a 3% hydrogen peroxide, 0.00025% Poloxamer, phosphonic acid and phosphates-based solution, was also evaluated and compared against PBS as a control.
3) Results
   a) All changes in lens parameters from cleaning with the RGP care solutions were within specified tolerances.
   b) The majority of the lens materials tested exhibited significantly less lysozyme deposition remaining on the lens after cleaning with the peroxide solution compared to PBS (all $p \leq 0.05$). There was no statistically significant difference ($p > 0.05$) in lysozyme deposition remaining on oprifocon A and hexafocon B materials between the test and control regimens.
4) Conclusions
   a) The RGP peroxide solutions demonstrated broad compatibility with the materials tested as defined by the ISO standard.
   b) A 3% hydrogen peroxide system containing 0.00025% poloxamer, phosphonic acid and phosphates was more effective at removing radiolabeled lysozyme compared to PBS for the majority of materials investigated.

Rapid Fire Poster 5: Can We Predict the Centration of OrthoK Lenses?

Randy Kojima, FAAO

1) Purpose:
   a) Orthokeratology lenses are worn during sleep to flatten the central cornea and provide quality vision during waking hours. Practitioners attempt to achieve the ideal “bulls-eye” topographical response which defines a well centered orthok effect1. Even with optimization of lens parameters, orthok treatment is often decentered to some degree2. This study set out to determine if pre-fitting topography analysis can predict the centration of orthokeratology lenses and their post wear effect.

2) Methods:
    a) This retrospective analysis reviewed the case files of 51 consecutive OrthoK patients with a successful one-month follow-up visit. All subjects were wearing the BE Free Orthok lens, and all were imaged pre and post wear using the Medmont topographer. The baseline topography was assessed in both axial and tangential displays. A novel circle tool was aligned, as best possible, to the peripheral corneal contours to define the direction (axis) of corneal displacement in relationship to the visual axis. Similarly, the circle tool was used on the post wear tangential map to define the position of paracentral steepening which follows orthok treatment. The pre and post fit axis of displacement was compared to determine the magnitude of differential.
3) Results:
    a) Axial analysis indicates that in 53% of cases the post wear treatment decenters to within ±30° of the pre-fitting axis of displacement. This extends to 71% of cases when including displacement of ±45°.
    b) Similarly, the Tangential analysis shows that 57% of outcomes decentered to within ±30° of the baseline displacement while 75% were within ±45°.
    c) In this study a novel circle tool was employed to analyze displacement both pre and post treatment. However, practitioners can perform this analysis by simply estimating the displacement of the color contours using any corneal topographer.
    d) Additionally, the findings would suggest that the pre fitting eye shape influences OrthoK lens centration. But in approximately 1 in 4 cases, the lenses do not follow the baseline topographical displacement. Further study is warranted to explore why lenses position counter to eye shape.
4) Conclusion
    a) This study suggests the pre-fitting corneal topography can be assessed to predict the centration of orthok lenses. In this study, the tangential analysis was slightly more accurate than the axial map although both are useful to estimate lens displacement.

Rapid Fire Poster 6: Your Weapon of Choice in Early Keratoconus and Mild Corneal Scars: Soft Toric Lenses

Sydney Krisa, BS, OD

Background: Rigid lenses are the backbone of contact lens wear for a variety of corneal conditions, but less complicated alternatives exist for patients with cases of mild to moderate corneal irregularity. This case series evaluates the success of fitting mild and moderate irregular corneas first with commercially available soft toric lenses.

1) Case Descriptions
    a) 66-year-old female for an RGP follow up in the setting of a stromal scar OS. She was experiencing discomfort, unstable vision, and excessive movement with the RGP OS. RGP fit was adequate with mild edge lift 360 and BCVA of 20/30+2. She was refit into Biofinity toric lens OS for a BCVA of 20/25+ and subjectively improved comfort and vision.
    b) 42-year-old female for a contact lens fitting in the setting of corneal scar OS with blur and haze in glasses. Vision OS was correctable in glasses to 20/20-. She was fit into a Biofinity toric lens with a great fit and BCVA of 20/20-. At the 1 month follow up exam, BCVA was 20/30 OS, but the lens was 1 month old and accumulated significant debris. An RGP trial lens was evaluated and

BCVA OS only improved to 20/25+. A new cleaning strategy with soft CL was decided before pursuing rigid lenses.

c) 50-year-old male with forme fruste keratoconus and fluctuating vision. BCVA in glasses was 20/30 OS. The patient was previously fit in a spherical Acuvue Oasys with BCVA OS correctable to 20/25+ and significant lens decentration. Patient was refit into Biofinity toric lenses and achieved BCVA of 20/20 OS. Vision, fit, and comfort remained excellent at follow-up.

2) Conclusions
   a) Contact lenses are a superior method of correcting vision in patients with corneal irregularity. The significant contribution of rigid lenses has been widely documented and utilized.
   b) However, this case series highlights the benefits of beginning with a commercially available soft toric lens in cases of mild corneal irregularity before pursuing a more complex and expensive fitting process.
   c) With the advanced technology of today's SiHy contacts, patients with low grade corneal irregularities can still achieve exceptional vision with a commercially available soft toric lens.

Rapid Fire Poster 7: Power profile and sagittal height differences of soft contact lenses indicated for myopia control

Giancarlo Montani, Dip.Optom

1) Purpose
   a) The best performance of a soft contact lens for myopia control is related to its optical performance and correct centration. Most of the lenses available for this aim are "one size" and their optical characteristics are often not available. This study aimed to report the differences in power profile and sagittal height of the most common soft contact lens used for myopia control to support ECPs in contact lens selection considering the patient's characteristics.
2) Method
   a) Six different soft contact lens design indicated for myopia control were selected for the study. Three lenses each in power -2.25D were stored in standard phosphate buffered saline for 24 h before to start the measures. The optical power profiles were measured using the NIMO EVO optical lens analyzer filling the wet cell to use during the measurements with buffered saline at 20°C. The sagittal height was measured using a spectral domain OCT-based lens analyzer (Optimec is830) for a controlled temperature of 20°C and 35°C to simulate the eye temperature.
3) Result
   4) Power profiles of contact lenses tested vary widely between the different designs presenting multiconcentric, aspheric, bifocal and EDOF profiles. Considering an optical zone measured of 6 mm also the difference between the minimum and maximum power between the different designs are high with a higher difference >5.00D for the EDOF lens and a lower difference of 2.25D for the multiconcentric design. The lenses tested were different between them for the sagittal depth too. Changes for the sagittal depth considering the same lens design were found also considering the temperature from of 20°C and 35°C.
5) Conclusion
   a) Considering the results obtained important differences between the lenses tested were found not just for the optical profile but also for the sagittal heights. It is so evident that not all lenses can induce the same effect for the control of myopia progression. These different designs can induce different interactions with the optics of the eye, with possible effects on peripheral

refraction, high order aberrations, accommodation, binocular vision and quality of vision. For a more effective myopia control treatment with soft contact lenses ECPs should measure the wearer's pupil diameter, ocular sagittal depth and ocular aberrations to select which contact lens design could be more effective.

Rapid Fire Poster 8: Optic Zone in Myopia Control with Ortho-K; Size Matters
Jaume Paune, OD, MOVsc, PhD

1) Purpose
   a) Optic zone treatment size in Orthokeratology is currently under high interest and deep study.
   b) We compared, in a retrospective study, the efficacy of controlling the annual increase in Axial Length (AL) in myopic Caucasian children based on two parameters: the back optic zone diameter (BOZD) of the orthokeratology (OK) lens and Plus Power Ring Diameter or mid-peripheral annular ring of corneal steepening.
2) Methods
   a) Data from 71 myopic patients (mean age, 13.34 ± 1.38 years; range, 10–15 years; 64% male) corrected with different back optic zone diameters of OK lenses (DRL, Precilens) were collected retrospectively from a Spanish optometric clinic.
   b) The mean baseline myopia was −3.11 ± 1.46 D and the AL 24.65 ± 0.88 mm.
   c) The sample was divided into groups with back optic zone diameters above or below 5.00 mm and the induced Plus Power Ring Diameter above or below 4.5 mm, and the relation to AL and refractive progression at 12 months was analyzed.
   d) Three subgroups were analyzed, i.e., Plus Power Ring inside, outside, or matching the pupil.
3) Results
   a) Significant ($p < 0.001$) differences were found after 12 months of treatment in the refractive error and AL for the back optic zone diameter and Plus Power Ring Diameter.
   b) AL changes in subjects with smaller back optic zone diameter decreased significantly regarding larger diameters (0.09 ± 0.12 and 0.15 ± 0.11 mm, respectively); in subjects with a horizontal sector of Plus Power Ring Diameter falling inside the pupil, the AL increased less ($p = 0.035$) than matching or outside the pupil groups by 0.04 ± 0.10 mm, 0.10 ± 0.11 mm, and 0.17 ± 0.12 mm, respectively. This means a 76% lesser AL growth of 0.13 mm/year in absolute reduction.
4) Conclusion
   a) OK corneal parameters can be modified by changing the OK lens designs, which affects myopia progression and AL elongation. Smaller back optic zone diameter induces a reduced Plus Power Ring Diameter that slows AL elongation better than standard OK lenses. Further investigations should elucidate the effect of pupillary diameter, Plus Power Ring Diameter, and power change on myopia control.

Rapid Fire Poster 9: Visual Improvement with Wavefront Guided Scleral Lenses After Penetrating Keratoplasty
Becky Su, OD

1) Purpose
   a) To report on the use of wavefront-guided (wfg) optics on a scleral lens (SL) for patients with a history of penetrating keratoplasty.
2) Methods

a) 7 eyes of 5 patients, all with a history of penetrating keratoplasty were fit with a traditional SL (tSL) with standard optics for distance correction. A wfg SL was created utilizing a comprehensive system (OVITZ, xWave, Rochester NY) that included a dot matrix on the SL and a wavefront aberrometer with iris and dot registration with direct data transfer.
b) Best contact lens visual acuity (BCLVA), and total higher-order root mean squared (HORMS) with pupil diameter matching were measured for each lens. Data was collected after at least 2 weeks of lens wear and a minimum of 3 hours of wear prior to examination.

3) Results
a) The average BCLVA for tSL was 0.11 ± 0.15 logMAR and 0.02 ± 0.09 for wfgSL. The average HORMS was 1.12 ± 0.48 for tSL and 0.60 ± 0.39 for wfgSL. WfgSL provided an average BCLVA improvement of 0.09± 0.09 ($P < 0.05$). WfgSL provided an average HORMs improvement of 0.48 ± 0.19 ($P = 0.01$).
b) All eyes showed a reduction of HORMS ranging from 27% to 68% with wfgSL.

4) Conclusion:
a) In eyes with a history of penetrating keratoplasty, wfgSL reduces HORMS and improves BCLVA when compared to tSL. Larger prospective studies are required to corroborate this data.

Rapid Fire Poster 10: Scleral Lens Imaged-guided Acquisition and Design for Patients with Ocular Surface Disease

Hannah Yoon, OD, MS

1) Purpose
a) To assess the feasibility of obtaining corneo-scleral profilometry (CSP) measurements using the Oculus Pentacam and of fitting image-based scleral lenses in patients with ocular surface disease.

2) Methods
a) In this IRB-approved, prospective single visit study, patients being fit into scleral lenses were identified as potential participants. Indication for lens wear, data relating to the CSP process (i.e., duration of scan, number of clinicians required for imaging, need for lid holding, number of scans required per zone, errors encountered during acquisition), and the scleral lens fitting process (i.e., number of visits, lenses ordered) were recorded.

3) Results
a) CSP images were acquired on 9 patients (15 eyes).
b) Ocular surface disease was the primary indication for scleral lens wear for all patients: keratoconjunctivitis sicca (6 patients, 6 eyes), neurotrophic keratitis (1 patient, 1 eye), limbal stem cell deficiency (1 patient, 1 eye), and neuropathic pain (1 patient, 1 eye).
c) A single clinician was able to acquire imaging for all patients. Mean scan time for right eyes was 10.7 ± 6.5 minutes and 9.7 ± 4.7 minutes for left eyes. The number of scans required to achieve an adequate and error-free scan was highest in the superior section for right eyes (2.7 ± 1.5 scans vs. 1.2 ± 0.4 central vs. 1.5 ± 0.8 nasal, 1.3 ± 0.5 temporal, 1.2 ± 0.4 inferior). For left eyes, the most scans were taken in the inferior section (2.4 ± 1.6 scans vs. 1.3 ± 0.5 central vs. 1.9 ± 1.2 nasal, 1.1 ± 0.3 temporal, 2.1 ± 1.7 superior).
d) For both eyes, the most common errors were blinking error, unsteady fixation, and lid closure.
e) All eyes required lid holding in the superior and inferior sections. Fitting was completed using image-based scleral lens design for 8 of 9 patients (14 eyes).

f) One patient was unable to tolerate scleral lenses. A mean of 3.38 ± 1.38 total visits were required to complete scleral lens fitting, with a mean of 2.7 ± 0.5 lenses ordered for right eyes, and 2.8 ± 0.9 lenses for left eyes.

4) Conclusion
   a) In this series, CSP technology was used to successfully design and fit image-guided scleral lenses in most patients with ocular surface disease.
   b) However, practice and experience with the CSP software, as well as an understanding of the imaging errors and how to address them are necessary to optimize scan quality and ultimately, the design of the initial lens ordered.