COPE Outline
GSLS 2023 Free Paper Session

Free Paper 1: The characteristic power profile of three soft contact lenses intended for myopia management

Tony Hough, BA

1) Purpose
   a) To specify the characteristic power profile of MiSight (CooperVision Inc), NaturalVue (VTI) and Medium Add SEED EDOF (SEED Co Ltd) soft contact lenses by quantifying the variation in power within the optic zone relative to the labeled power.
2) Methods
   a) The power profiles of lenses having labelled powers of -1.00D to -5.00D in 0.50D steps in each of the products MiSight, NaturalVue and Medium Add SEED EDOF ranges of soft contact lenses were measured using a Rotlex Contest instrument.
   b) The test protocol followed ISO methods. Five independent measurements were taken for each of three lenses in each of the nine labeled powers (135 independent measurements per product).
   c) Measurements were double masked and randomized. The resulting individual power profiles were used to calculate a zero-adjusted power profile for each product which specifies the variation in power within the optic zone relative to the label for any power.
3) Results
   a) The MiSight lens is a 4-zone center distance ring bifocal having alternate annuli of distance and near power. The zone diameters are 2.90, 5.00, 6.40 and 8.00mm. The distance zones have powers +0.37D and the near zones +2.20D relative to the label.
   b) The NaturalVue lens has a central varifocal zone 5.40mm in diameter in which the power becomes increasingly positive. The vertex power -0.25D relative to the label; the power at 5.40mm is +2.60D relative to the label. This is surrounded by an annulus which is -1.75D relative to the label.
   c) The SEED EDOF lens has a 1.60mm central distance zone in which the power is +0.37D relative to the label. The power then becomes progressively more positive to a maximum value of +1.28D relative to the label at a diameter of 2.56mm. From this point the power becomes increasingly more negative with a declining oscillating profile having two further peaks. At the edge of the optic zone the power is -1.25D relative to the label.
4) Conclusions
   a) Based on the results of this work, the medium- and long-term outcomes for myopia management using the products here would not be similar.
   b) We would expect the quality of vision with all three products and especially with the VTI and SEED products to be inferior to single vision minus powered soft lenses.

Free Paper 2: Predicting Scleral Topography from Corneal Topography

Raymond Chartier, OD

1) Purpose:
   a) The purpose of this research is to determine if corneal shape at a 10mm chord is predictive of corneal shape at a 16mm chord, to possibly assist in scleral lens fitting.

2) Methods:
    a) Corneal and scleral topography was obtained on 30 eyes of 15 subject without irregular astigmatism using a Pentacam (Oculus) with corneal scleral profile (CSP) software.
    b) The sagittal depth and toricity of the flat and steep meridians at a 10mm corneal chord were then compared to the sagittal depth and toricity of the flat and steep meridians at a 16mm scleral chord. The data was analyzed with power vectors.
    c) A spherical equivalent (SE), J0 (with the rule (WTR) and against the rule (ATR)), and J45 (oblique (OA)) plots were populated to show if there was any correlation between the corneal and scleral at a given axis.
3) Results:
    a) For the SE there was a strong correlation between the corneal and scleral sag and toricity (R2=0.8493).
    b) This SE R2 value indicates that the average scleral sagittal depth at a 16mm cord is ~2.35x greater than the average corneal sagittal depth at a 10mm chord.
    c) The J0 WTR/ATR plot showed a mild correlation (R2=0.3312) indicating that scleral toricity can be predicted with minor certainty from corneal toricity especially in WTR patients.
    d) The data suggest that scleral toricity at 16mm is typically less than corneal toricity at 10mm and is equal to 0.1256x+18.34 where "x" is equal to the corneal toricity at 10mm.
    e) Finally, the J45 OA showed no correlation (R2=0.0094) indicating in patients with corneal OA their scleral toricity cannot be predicted from their corneal toricity.
4) Conclusion:
    a) In regular eyes, without ectatic pathology, there does seem to be a minor correlation between corneal and scleral toricity in WTR and ATR corneas.
    b) However, in cases of OA corneal toricity is not a reliable source of information. This implies that in the absence of scleral topography for WTR and ATR a clinician can infer with some certainty the scleral toricity and implement the data into the choosing an initial scleral lens.
    c) It is of note that there is a minor skewing of data as both eyes of the subjects were used, and individuals' eyes usually have similar topographic maps. Furthermore, this data only applies to regular corneas.
    d) For corneas with irregular astigmatism (i.e. keratoconus) the results and conclusions cannot be applied.

Free Paper 3: Visual Quality Assessment and Comparison of Different Scleral Lens Designs

Juan Gonzalo Carracedo Rodríguez, PhD

1) Purpose:
    a) To compare the visual performance of two multifocal scleral lens designs, with conventional-optics and decentered-optics, and a monofocal design.
2) Methods:
    a) Ten adult patients, (53.8±5.35 years), with irregular corneas volunteered to participate in this study after signing the written informed consent. The clinical evaluation was performed at the Optometry Clinic of the Complutense University of Madrid (Spain).
    b) Patients were fitted with three Onefit MED® scleral lens designs: a monofocal design (MS), a conventional multifocal design (CMS) and a multifocal design with the optical zone decentered (DMS), following the manufacturer's fitting guide.

c) The results obtained with the three scleral lens designs and with spectacle correction (SC) were compared. Binocular defocus curves, stereopsis and subjective quality of vision and comfort were evaluated. Values were analyzed and are presented as mean ± SD. A p-value<0.05 was considered statistically significant.

3) Results:
   a) Distance BCVA with MS lens was 0.05±0.16, 0.06±0.15 for CMS lens and 0.06±0.13 for DMS lens (p>0.05). A statistically significant improvement was obtained for intermediate BCVA with DMS lens, 0.15±0.15 and CMS, 0.16±0.13, compared to SC, 0.28±0.10, (p<0.05). Significantly better near BCVA was also obtained with the DMS design compared to MS and SC, 0.12±0.14, 0.27±0.14 and 0.32±0.10, respectively (p<0.05). However, there was no significant differences between DMF and CMF designs (0.18±0.18) (p>0.05).
   b) No statistically significant differences were found for stereopsis between any of the three designs (p>0.05), but differences were found when comparing with SC (p<0.05). For distance vision, a significant statistical improvement was found in subjective vision, with the three scleral lens designs (DMS 86±8.21, CMS 79±6.81 and MS 80.6±8.5) compared to SC 67±15.77 (p<0.05), with better values to DMS comparing with the CMF and with the MF (p<0.05).
   c) For near vision, the best rated lens was the DMF (86±10.46), although there was no significant difference when compared to the CMF (80±8.58) design (p>0.05). With respect to comfort, statistically significant improvement were found when comparing the three scleral lens designs with SC (p<0.05).
4) Conclusions:
   a) Multifocal scleral lenses with decentered-optics design showed better visual performance compared to conventional multifocal design and spectacle correction.

Free Paper 4: Comparing Sagittal Heights Calculated Using Corneal Parameters and those Measured with Profilometry

Javier Rojas Viñuela, GO, MSc

1) Purpose:
   a) To compare the visual performance of two multifocal scleral lens designs, with conventional-optics and decentered-optics, and a monofocal design.
2) Methods:
   a) Ten adult patients, (53.8±5.35 years), with irregular corneas volunteered to participate in this study after signing the written informed consent.
   b) The clinical evaluation was performed at the Optometry Clinic of the Complutense University of Madrid (Spain).
   c) Patients were fitted with three Onefit MED® scleral lens designs: a monofocal design (MS), a conventional multifocal design (CMS) and a multifocal design with the optical zone decentered (DMS), following the manufacturer's fitting guide.
   d) The results obtained with the three scleral lens designs and with spectacle correction (SC) were compared.
   e) Binocular defocus curves, stereopsis and subjective quality of vision and comfort were evaluated. Values were analyzed and are presented as mean ± SD. A p-value<0.05 was considered statistically significant.

3) Results:
    a) Distance BCVA with MS lens was 0.05±0.16, 0.06±0.15 for CMS lens and 0.06±0.13 for DMS lens ($p>0.05$).
    b) A statistically significant improvement was obtained for intermediate BCVA with DMS lens, 0.15±0.15 and CMS, 0.16±0.13, compared to SC, 0.28±0.10, ($p<0.05$).
    c) Significantly better near BCVA was also obtained with the DMS design compared to MS and SC, 0.12±0.14, 0.27±0.14 and 0.32±0.10, respectively ($p<0.05$). However, there was no significant differences between DMF and CMF designs (0.18±0.18) ($p>0.05$). No statistically significant differences were found for stereopsis between any of the three designs ($p>0.05$), but differences were found when comparing with SC ($p<0.05$).
    d) For distance vision, a significant statistical improvement was found in subjective vision, with the three scleral lens designs (DMS 86±8.21, CMS 79±6.81 and MS 80.6±8.5) compared to SC 67±15.77 ($p<0.05$), with better values to DMS comparing with the CMF and with the MF ($p<0.05$).
    e) For near vision, the best rated lens was the DMF (86±10.46), although there was no significant difference when compared to the CMF (80±8.58) design ($p>0.05$). With respect to comfort, statistically significant improvement was found when comparing the three scleral lens designs with SC ($p<0.05$).
4) Conclusions:
    a) Multifocal scleral lenses with decentered-optics design showed better visual performance compared to conventional multifocal design and spectacle correction.

Free Paper 5: Real-World Efficacy of Orthokeratology Versus Peripheral Defocus Contact Lenses

Erin Tomiyama, OD, PhD

1) Purpose:
    i) To assess the real-world efficacy of peripheral defocus contact lenses (PDCLs) and orthokeratology (OK) in an academic myopia management service.
2) Methods:
    a) Records from January 2015 to January 2022 were retrospectively reviewed to identify patients, aged 5-18 years, who were treated with OK or PDCLs. Any patients who had previous myopia management therapy, except for bifocal glasses, or were not compliant with their therapy (discontinued for ≥ 2 consecutive months) were excluded. A total of 523 visits from 135 patients were included. Axial length and cycloplegic spherical equivalent refractive error were obtained using a standardized protocol. Corneal thickness adjusted annualized rates of axial length progression were calculated and used as the response variable in both linear mixed-effects (LME) and nonlinear regression models.
3) Results:
    a) Children were 10.7 years old at baseline (range 6.4-15.7 years, $p = 0.144$ between treatments), and primarily female (62%, $p = 0.664$). More Asian children wore OK ($p = 0.008$). Overall, children had ~3.00 D of myopia and 0.75 D of astigmatism in both treatment groups ($p > 0.200$ between treatments).

b) LME regression models showed no evidence that annualized change in axial length differed between OK and PDCL, with or without inclusion of age, race, sex, or baseline axial length or spherical equivalent refractive error.
c) Effect sizes for treatment condition was 0.069 [95%CI = (-0.008, 0.146); p = 0.102] in the fully adjusted model. Age at baseline was statistically significant in models that did not include spherical equivalent refractive error with an effect size of -0.261 [95%CI = (-0.445, -0.078); p = 0.009] in an initial model with treatment and baseline age as the only predictors.
d) Sex, race, and baseline axial length and spherical equivalent refractive error were not significant in any of the models.
e) Further, there was no statistical difference between parameters of an exponential decay model fitted within treatment using follow-up age as a time-varying predictor, indicating that the rate of annualized change in axial length was similar for OK and PDCL.

4) Conclusions:
a) There was no difference in annualized axial length growth between PDCL and OK in this retrospective analysis of real-world clinical data.
b) The axial length progression from this academic setting is consistent with those reported in randomized clinical trials.