



Objective Spherical Refractive Error Estimation Using Ocular Biometrics

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Abstract

Objective: To investigate the potential of clinical application spherical refractive error (SpRx) estimation using Ocular Biometrics (OB).

Methods: 28 children aged from 6 to 14 years old with inter-ocular SpRx difference between 1 to 2 Dioptres (D) were recruited. Both eyes were measured with non-cycloplegia subjective refraction. OB was performed by the IOLMaster 700 (Carl Zeiss Meditec, Jena, Germany). For OB SpRx estimation, right eye Intraocular Lens Power (IOL), (A constant 118) was taken with right eye SpRx, the flattest central corneal curvature (FK) and Axial Length (AL) using SRK/T formula. Left eye OB SpRx was taken using identical calculation with right eye IOL, left eye FK and AL respectively.

Results: No statistically inter-ocular differences were observed of the average FK ($p=0.84$) and average lens thickness ($p=0.88$), but not average AL ($p<0.01$). Average left eye SpRx by OB estimation and subjective refraction were determined as $-2.86\pm1.02D$ and $-2.82\pm1.16D$ (mean $\pm$ SD) respectively. No significantly difference ($p=0.84$) and highly correlation ($r=0.94$, $p<0.01$) were found.

Conclusion: Objective SpRx appears to be reliably estimated using OB. It likely provides a crucial SpRx reference for comparison with subjective refraction. OB SpRx may also play a vital role for monitoring the children myopic progression.

Keywords

Ocular Biometrics; Optical Biometry; Myopic Progression; Axial Length; Refractive Error

Introduction

Intraocular Lens power (IOL) calculation for cataract surgery was generally determined using precise formula with Ocular Biometrics (OB) [1-3]. The spherical refractive error (SpRx) theoretically should be estimated meaningfully with OB. Interestingly little attention has been devoted to clinically estimate SpRx using OB such as the flattest central corneal curvature (FK), lens power and Axial Length (AL). The reason is likely due to the fact that lens power seems difficult to be assessed clinically [4]. Regarding that the IOL would be consistently calculated for the truthful desired post-surgery refractive power, it infers that the SpRx would be also estimated using IOL, FK and AL. The objective of this study was to examine the agreement of SpRx estimated by OB and measured by subjective refraction. Published reports generally suggested that the myopic anisometropic eyes were mainly due to inter-ocular AL deviation [5,6]. Thus this study was designed to assess the association of SpRx estimated with FK, AL and the follow eye IOL and measured by subjective refraction in the myopic anisometropic children.

Methods

28 children aged from 6 to 14 years old with inter-ocular SpRx difference between 1 to 2 Dioptres (D) were recruited. Verbal consent was obtained from children and their parents. Both eyes were measured with non-cycloplegia subjective refraction. Subjective refraction was made using a trial frame and trial lenses with maximum plus for maximum visual acuity technique. OB was performed by the IOLMaster 700 (Carl Zeiss Meditec, Jena, Germany). For the OB SpRx estimation, right eye intraocular lens power (IOL) (A constant 118) was taken with right eye SpRx, FK and AL using SRK/T formula. Then left eye OB SpRx was taken using identical calculation with right eye IOL, left eye FK and AL respectively. Shapiro-Wilk test was to determine the normality of all parameters. Paired t-tests and Pearson's correlation coefficient was used to compute the relationship between the OB estimated and subjectively measured SpRx.

Results

No statistically inter-ocular differences were observed of the average FK ($p=0.84$) and average lens thickness ($p=0.88$), but not average AL ($p<0.01$). Average left eye SpRx by OB estimation and subjective refraction were determined as $-2.86\pm1.02D$ and $-2.82 \pm 1.16D$ (mean $\pm$ SD)

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respectively. No significantly difference ($p=0.84$) and highly correlation ($r=0.94$, $p<0.01$) were found.

Discussion

This may be the first study to examine the association between the OB estimated and subjectively measured SpRx. It regularly advises that inter-ocular myopic SpRx difference was mainly attributed to the AL deviation in children [5,6]. Our data also presented similar phenomenon that no significant difference of inter-ocular FK and lens thickness but a notable deviation in AL were found in myopic anisometropia children. This implies that SpRx may be rationally estimated using the follow eye lens power. Predictably our study showed a good agreement between SpRx estimated using follow eye IOL and measured by subjective refraction. Our outcomes proposed that OB estimated SpRx would be practiced consistently for objective refraction error measure.

It is unquestionable that using individual eye IOL for OB SpRx estimation should be more accurate. During the youngster, it was shown that refractive ocular component was stable and axial elongation was the primary ocular component in myopia progression [7,8]. Primarily calculated IOL of individual eye would be regarded as the baseline parameter and should be reliably used again for the future SpRx estimation. This may provide one more crucial reference SpRx for the children myopic progression evaluation. Today AL is commonly regarded as a vital indicator for monitoring myopic progression, but seems mainly using for research purpose [9]. OB estimated SpRx with current AL could be applied well for judgement with other objective and subjective measures. Apart from the objective and non-invasive nature measure, there are two more advantages of the estimated OB SpRx for observing the child myopic progression. Since the estimated OB SpRx was presented in 0.01D, it would be more sensitive to the power change compared with current SpRx measures. In the condition that the baseline IOL was taken at cycloplegic state, the future estimation may be also considered as cycloplegic SpRx. However, OB estimated SpRx would not be applied trustworthily for children under corneal refractive management since their corneal curvatures are unstable.

In conclusion, SpRx was estimated using OB appears in close agreement with measured by subjective refraction. OB estimated SpRx would clinically provide a useful means about the extent of myopia progression.

Conflict of Interest

The author declares no conflict of interest, financial or otherwise.

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