



CASE REPORT

Visual performance with changes in eccentricity in PROSE device: A case report

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KEYWORDS

Keratoconus;
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Abstract This case report describes the variations in visual performance of a subject with moderate keratoconus with changes in front surface eccentricities (FSEs) of PROSE (Prosthetic Replacement of Ocular Surface Ecosystem). PROSE device of 0.6 FSE provided maximum visual improvement and reduction in Higher Order Aberrations (HOAs) compared to 0, 0.3 and 0.8 FSEs in this clinical condition.

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PALABRAS CLAVE

Queratocono;
Dispositivo PROSE;
Excentricidad de la
superficie frontal

Rendimiento visual con cambios de excentricidad en el dispositivo PROSE: informe de un caso

Resumen Este informe de un caso describe las variaciones del rendimiento visual de un paciente con queratocono moderado con cambios de las excentricidades de la superficie frontal (ESF) de PROSE (Sustitución protésica del ecosistema de la superficie ocular). El dispositivo PROSE de 0,6 ESF aportó una mejora visual máxima y una reducción de las aberraciones de orden superior, en comparación a ESF de 0, 0,3 y 0,8 en esta situación clínica.

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Introduction

Keratoconus (KC) is a bilateral, asymmetric, corneal disorder that results in progressive thinning, steepening, irregular astigmatism, and potentially scarring.¹ PROSE device formerly known as Boston Scleral lens is a prosthetic device which resembles transparent domes vaulting the damaged cornea and resting on the sclera.² PROSE device

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maintains stable ocular surface environment, masks the corneal irregularity and thereby enhances vision in Irregular corneal conditions.²⁻⁴

Irregular corneal conditions gives rise to HOA like coma, spherical aberrations, trefoil and tetra foil creating visual disturbances or symptoms like shadowing, starbursts, ghost images, reduction in contrast sensitivity and distorted night vision.^{5,6} Use of FSE in PROSE device has shown to reduce the HOA and thereby improve the visual performance in subjects with Irregular corneas and Ocular Surface disorders.⁷

This case demonstrates the clinical impact of different eccentricities of the PROSE device on aberrations and visual performance.

Case report

A 15-year-old female subject suffering from bilateral keratoconus presented with complaint of gradual diminution of vision in right eye. The best corrected visual acuity was 6/12 with a rigid gas permeable corneal lens. Further examinations confirmed severe keratoconus with vogt's striae and apical scarring in right eye and healed acute hydrops in left eye.⁸ The keratometric reading was 63.50 @139/72.37 diopters and was unobtainable for the left eye. The subject was recommended for PROSE device trial.

The initial trial was performed to achieve an optimal fitting characteristic which includes an adequate vault, a clear front surface with no haptic compression, no edge lift and no impingement staining. In a clinical set up, the availability of devices with varying eccentricities with other specifications being constant is a rare scenario. Since for this particular subject devices of all FSEs 0, 0.3, 0.6 and 0.8 were available with the other parameters being constant, PROSE device with different FSE was tried on the subject to observe the trend in visual performance and aberrations. PROSE device specifications include the vault, diameter, base curve, power, eccentricity and the haptic measurements. The device specifications optimal for the right of the patient was 5.3 vault, base curve 7.90, power 0.01, diameter 19.5 and 14.00 haptic. All the devices had the same parameters except the FSE, which varied as 0, 0.3, and 0.6 and 0.8.

Best corrected high contrast visual acuity (HCVA) 90% and low contrast visual acuity (LCVA) 10% were recorded using logmar chart and aberration using Complete Ophthalmic Analysis System Wave front Aberrometer (COAS-HD™ Model 2800, WaveFront Sciences, Inc., Albuquerque, USA). The aberrometric measurements were performed with PROSE device in situ under scotopic conditions with natural pupil size above 6.0 mm.

HCVA was found to be 0.2 logmar units which were similar with 0, 0.3 and 0.6 FSE while it was reduced to 0.3 logmar units with 0.8 FSE. LCVA was 0.4 logmar units with 0.3 and 0.6 FSE. HCVA and LCVA with the device of 0.3 FSE was 0.2 logmar units and 0.4 logmar units respectively. A drop in LCVA by 2 lines was observed with device of 0 and 0.8 FSE. In this case, as FSE increased HOAs also increased except trefoil. Even though an increase in horizontal trefoil was observed with device of 0.3 FSE, there was a reduction of vertical trefoil. The total trefoil however seems to decrease with 0.6 FSE.

Discussion

As the goal of fitting PROSE was to derive a device that provided maximum achievable visual acuity, this clinical evaluation with different FSE in PROSE with other parameters being constant was planned.

A previously done case series which assessed effects of different optic asphericities on keratoconus subjects showed mixed results.⁹ In a group of 5 patients fitted with Boston Scleral lens, some of them showed a drop in HCVA, BCVA and LCVA while HCVA and BCVA increased in others. In other study the Impact of Boston Scleral lenses and spectacles on HOA was compared. This study showed reduction in HOA when FSE of 0.6 was induced.⁷ A difference in visual performance was also noted in subjects with corneal scarring with changes in FSE.¹⁰

The visual disturbances arising due to increase in HOA have considerable impact on subjects' daily living.¹¹ These HOAs can be explained as a result of differences in shape factor due to the corneal irregularity and possible changes in the first refractive surface due to the change in optics with different type of lenses. Present literature shows lack of adequate study with posterior corneal surface and PROSE device although a study done in Japan showed that posterior corneal surface also had an impact on HOA in a group of keratoconic subjects. The study explained that HOA on anterior corneal surface was three to four times larger than posterior surface.¹²

In this case, PROSE device with FSE of 0.3 and 0.6 provides optimal HCVA and LCVA. The subject was prescribed with a device of 0.6 FSE considering the visual performance and subjective assessments of comfort and glare.

Conclusion

This case illustrates the potential of PROSE device with FSE to improve low contrast acuity when compared to a device without FSE in moderate keratoconus. The results would help in initial trial lens selection, considerably reduce the chair time and thereby guide in prescribing appropriate FSE in irregular corneal conditions. Although higher FSE was found to improve visual performance, reversal effect if any with higher FSE must be evaluated cautiously while prescribing. Quantitative measurements of visual disturbances experienced by the subject would be beneficial while prescribing the device.

Conflicts of interest

The authors have no conflicts of interest to declare.

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