Visual acuity improvement in bilateral corneal scars following the use of rigid gas permeable contact lens : a case report

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Background: Corneal scarring often results in impaired visual acuity due to irregular astigmatism inadequately corrected with spectacles. Rigid gas permeable (RGP) contact lens (CL) offers a practical, less invasive, and less expensive alternative to surgery in negating the irregular astigmatism of eyes with corneal scars.

Case description: A 40-year old female presented with blurred vision of both eyes since a year ago with a history of recurrent redness on both eyes. Her visual acuity was 6/30 on the right eye and 6/15 on the left eye uncorrected with pinhole. There were multiple scars with vascularization on bilateral corneas without active signs of inflammation. Fitting for RGP CL was performed. Keratometry readings were obtained with distorted mires. The corneal topography showed irregular patterns. A trial was performed using a tisilfocon A lens with base curve 8.40 mm for the right eye and 7.60 mm for the left eye, power S-4.00D and diameter 9.20 mm. Over-refraction with the trial lens could determine the final power and the final visual acuity achieved with the RGP CLs was 6/15 on the right eye and 6/7.5 on the left eye.

Conclusion: With proper fitting, RGP CL can be a treatment option in improving the visual acuity for patients with corneal scars, thus helping to further delay surgical treatment and improve patient's quality of life.

Conflicts of Interest: The authors have no financial interest in the subject matter of this case report.

Keywords: Rigid gas permeable contact lens, corneal scars, irregular astigmatism, irregular cornea, contact lens fitting

EyeSEA 2019;14(2):35-41

DOI: https://doi.org/10.36281/2019020106

Introduction

Corneal scarring often results in impaired visual acuity by light scatter due to an irregular corneal surface. Such patients often have co-existing high irregular astigmatism which cannot be adequately corrected with spectacles in most cases. Global estimates suggest that corneal opacities cause accounts for 4% of total blindness in 2010.[1] Based on 2013 Basic Health Research the prevalence of corneal opacities in Indonesia is 5,5%.[2]

One of the non-surgical management for improving visual acuity is contact lens. Rigid gas permeable (RGP) contact lens (CL) helps in negating the irregular astigmatism due to corneal scarring, by providing a smooth refracting surface.[3] Prior studies have reported successful use of RGP

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Received : 22nd Jan 2019
Accepted: 4th July 2019
Published: 10th November 2019

CL in improving vision in cases of corneal opacities.[3-10]

This is a case of bilateral corneal scars which causes irregular refractive surface and opacities in the stroma that could not be fully corrected with spectacles, thus RGP CLs were chosen as management. This report aims to demonstrate that RGP CLs with proper fitting can be an alternative option for patients with corneal scars in improving the visual acuity.

Case Discription

A 40-year old female came to the hospital with a chief complaint of blurred vision of both eyes since a year earlier. There was a history of recurrent redness on both eyes, sometimes unilateral, with no discharge since two years ago. She instilled an eyedrops containing combination of steroid and antibiotics and the redness subsided but the blurred vision remained. There were whitish appearances on both eyes over time. There was no history of chronic cough, skin rash, joint pain nor hair loss. There was no history of wearing contact lens nor spectacles. There was no history of ocular trauma nor systemic disease. She denied any similar condition in her family.

Upon ophthalmological examination, the patient's initial visual acuity (VA) was 6/30 on the right eye and 6/15 on the left eye uncorrected with pinhole. The potential acuity measurements examined by retinometry were 0.8 (equivalent to 6/7.5) and 0.9 (equivalent to 6/6.6). There were translucent fibrovascular tissue on both eyes. The fibrovascular tissue on the left eye was thicker than the right, but both only extend from the lateral canthus to the limbus. There were also multiple epithelial and stromal scars with vascularization, located centrally and paracentrally on the bilateral corneas, but without active signs of inflammation on the anterior segment. The scars rae quite prominent, especially in the left eye, so hat the iris detail can not be visualized well. The pupils of both eyes were round, central, with positive light reflex. The posterior segment of both eyes was normal. She was diagnosed with multiple corneal scars of both eyes. The etiological differential diagnosis includes infectious keratitis dan immune related keratitis. And she was then referred for RGP CLs.

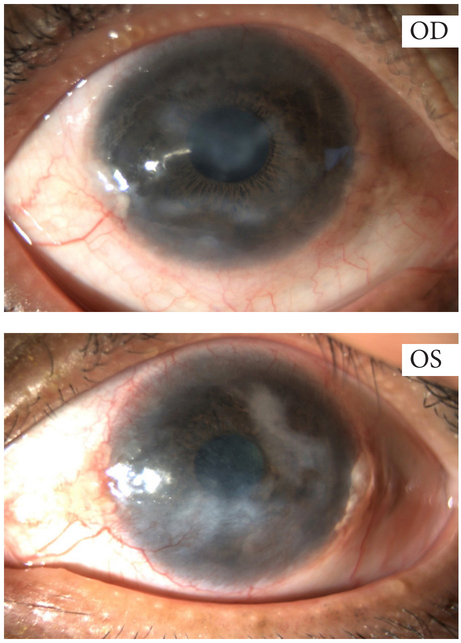

Figure 1: The profiles of the cornea of both eyes, as seen from the anterior with the slit lamp. There are significant multiple scars with neovascularization.

Although thew mires during manual keratometry were formed with some distortions, the corneal curves could be determined approximately 40.75 D (8.7 mm) at 0° for horizontal curvature and 46.75 D (7.2 mm) at 90° for vertical curvature in the right eye, while in the left eye the keratometry readings were 43.00 D (7.85 mm) at 5° for horizontal curvature and 51.00 D (6.50 mm) at 95° for vertical curvature. The corneal topography of the right eye showed that the radius of horizontal curvature was 8.97 mm and the radius of vertical curvature was 6.98 mm, while the corneal topography of the left eye showed that the radius of horizontal curvature was 7.64 mm and the radius of vertical curvature was 6.79 mm.

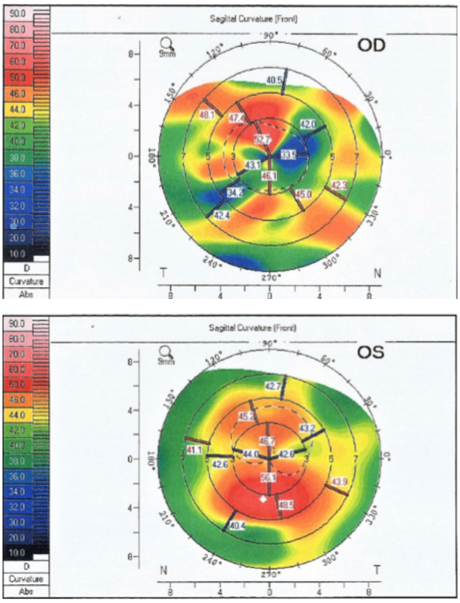

Figure 2: The corneal topography of both eyes showed irregular patterns.

Trial fitting for RGP CL was then performed tisilfocon A (Menicon Z α) lens with base curve 8.40 mm for the right eye and 7.60 mm for the left eye, power spherical -4.00 Diopter and diameter 9.20 mm for both eyes. There was a temporal/ inferior CL decentration on the right eye, but the pupil was still covered by the lens. While on the left eye, there was an inferior decentration approximately 1 mm. The movement on blink was adequate, although there was a rocking movement of the CL in the right eye. Instillation of the fluorescein eyedrops and examination with cobalt blue light showed irregular patterns on both eyes but with relatively good central alignment. Overall, it was an acceptable fitting.

The overrefraction with the trial lens revealed residual errors of spherical +6.00D in the right eye and of spherical +4.00D in the left eye while the best corrected visual acuity (BCVA) was 6/15 on the right eye and 6/7.5 on the left eye. Menicon Z α were then ordered for her with parameters as follow: base curve 8.40 mm with power +2.50D and diameter 9.20 mm for the right eye and base curve 7.60 mm with power +0.25D and dimeter 9.20 mm for the left eye.

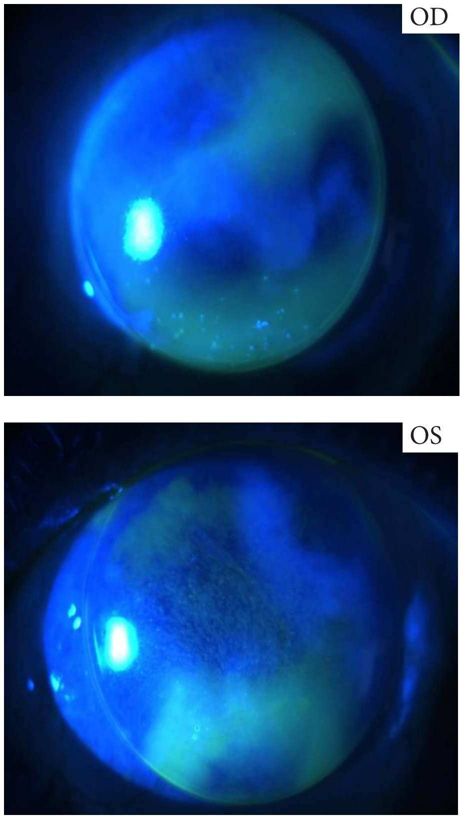

Figure 3: Irregular patterns on both eyes after fluorescein application with the RGP CLs.

Patient received ordered RGP at the next visit and was educated on how to wear and take care of the CLs. The patient was educated how to wear and take care the CLs. The visual acuity with the RGP CLs was measured and there was similar visual acuity as measured at the trial. A week

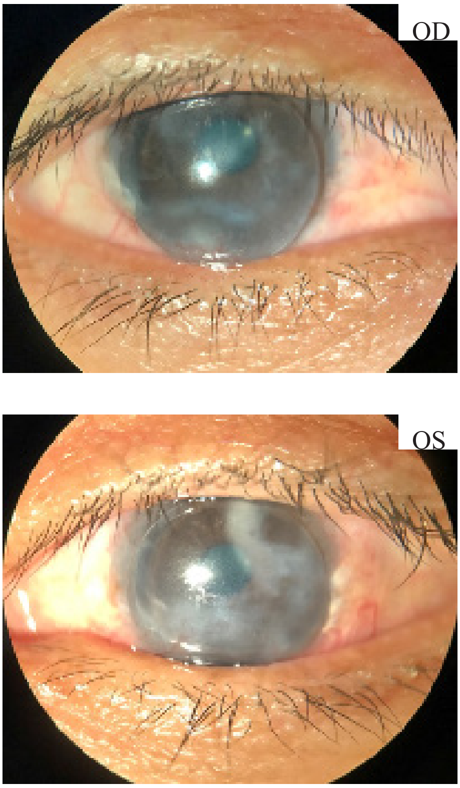

Figure 4: The patient wearing the RGP CLs, some decentrations were shown but with adequate pupil coverage.

after wearing the CLs, the patient noted significant subjective visual improvement with the CLs with no complaints about the CLs wear. The patient reported that overall comfort was also improving, as she was able to wear the lenses every day for a maximum of 12 hours a day.

Discussion

Corneal opacities occur when altered stromal keratocytes either fail to produce certain chemical factors after infection, trauma, or surgery or form underlying disease or dystrophy. New collagen fibers become disorganized, scatter light, and result in a non-transparent scar.[11] Corneal opacity causes irregular astigmatism due to irregularities of the corneal surface.

Irregular astigmatism occurs when the orientation of the principal meridians changes from one point to another across the pupil, or when the amount of astigmatism changes from one point to another. Irregular astigmatism may also be defined as an astigmatism state not correctable by a sphero-cylindrical spectacle lens. A comprehensive definition by Duke Elder states that irregular astigmatism is a refractive state in which refraction in different meridians conforms to no geometrical plan and the refracted rays have no planes of symmetry. Irregular astigmatism has been considered an uncommon refractive error. The astigmatism compensation with spectacle lenses is possible if the primary meridians are perpendicular because ophthalmic astigmatic lenses can only correct orthogonal astigmatisms.[12]

It is difficult to correct irregular with standard spectacles, since ophthalmic astigmatic lenses correct only orthogonal astigmatism where primary meridians are perpendicular.[12] Therefore, contact lens could be a choice to improve visual acuity in cases with irregular astigmatism.[6,12] Rigid gas permeable contact lens may be the lens of choice, since it provides good visual acuity, corrects high degrees of regular and irregular astigmatism, has high oxygen permeability, and, in comparison with soft contact lenses, carries a lower risk of microbial keratitis and corneal neovascularization.[13]

Since the refractive index of tears and cornea is similar, the tear lens can neutralize more than 90% of the regular and irregular corneal astigmatism. The tear lens is an additional lens in which the anterior curvature radius is determined by the back RGP lens radius, and the posterior radius coincides with the anterior corneal curvature. Therefore, the difference in the power of the steepest and flattest corneal meridians is neutralized by the RGP CLs. It masks the underlying irregular cornea and provides a new refractive surface.[14]

In this case, the patient came with the chief complain of blurred vision in both eyes, with a history of recurrent keratitis. Corneal scars on both eyes was found from slit lamp examination. The right eye initial visual acuity was 6/30 and the left eye was 6/15, uncorrected with pinhole. The manual keratometry showed +6.00D at 90^o astigmatism on the right eye and +8.00 at 90^o astigmatism on the left eye, both with distorted mires. Therefore, this was a case of high irregular astigmatism due to corneal scars. Since RGP CLs offers several advantages, such as superior vision due to correction of corneal cylinder and greater contrast sensitivity, long-term comfort after adaptation, durability, and ease of care, and higher oxygen permeability values, we decided to manage this patient's condition with RGP CLs. [13,15]

However, extra care must be taken into consideration before deciding to treat this patient with contact lens since it was suspected that the corneal opacities were caused by infection. It must be assured that there was no active inflammation or infection before CL fitting. Precise RGP fitting is important to optimize the refractive correction. There are some individualized parameters that need to be determined before the fitting, including base curve radius, overall diameter, lens material and design, lens power, and center thickness.

From the patient's keratometry readings, there were high astigmatism. the base curves selected for both eyes were 0.3 mm steeper than the flattest K. An "on K" BCR fitted on a highly astigmatic cornea will not only provide very little corneal alignment and subsequent decentration, but the resulting areas of bearing and excessive clearance may also result in lens "rocking" on the cornea with the blink, discomfort caused by an increase in edge contact with the upper lid, and corneal desiccation.[15] The manual keratometry readings with distorted mires could not show an irregular astigmatism in this patient, so corneal topography is needed since it is better in measuring irregular astigmatism more accurately. With corneal topography, an asymmetry between the superior and inferior or nasal and temporal halves of the cornea may also be identified.[12] In this patient, the corneal topography of both eyes showed irregular patterns.

The lens design chosen for this patient was an aspheric lens, which provides better centration on irregular astigmatic corneas. Aspheric designs may follow the corneal shape closely, lessening areas of contact between the lens and peripheral cornea, thus enhancing tear fluid exchange and corneal wettability. Furthermore, aspheric lens designs can minimize lid–lens interaction, thereby decreasing discomfort and interference with blinking habits.[15] The diameter of the lens chosen for fitting was 9.20 mm, which was the only diameter available in the trial lens kit and an average for normal corneal size.[3] The power of the lenses was determined by over-refraction since the manifest refraction could not be obtained in this case. The final power was the sum of the trial lens power and the over-refraction. Measuring the over-refraction during a rigid lens trial fitting not only helps to determine the final lens power but also gives an indication of whether the optimum fit has been obtained.[16]

The next step was to see the centration of the trial lenses. For an irregular cornea, the fluorescein pattern nearly always shows the irregularity of the corneal surface.[16] In this case, the patterns and the movement when blinking were consistent with the corneal topography profiles. The fitting is decided according to visual improvement.

In this case, RGP CL that was chosen for fitting and subsequently for use was a tisilfocon A material which has the highest oxygen permeability (Dk) value of 163 barrers.[15] This lens material is a polymer composed of siloxanylstyrene, fluoromethacrylate, and benzotriazol UV absorber. The hyperpermeable material makes it well suited for diseased eyes that require adequate oxygenation for successful contact lens wear.

From the slit lamp examination, the corneal opacities are different between the two eyes. The scars in the right eye are more diffuse and superficial, while in the left eye they are denser but located paracentrally. The fine, diffuse regular opacity involving the pupillary axis more commonly interferes with vision than the localized, dense cicatricial lesion outside of the visual axis. These opacities irregularly refract light and blur the retinal image. In cases of deep lesions that produce scars outside the visual axis, visual rehabilitation is more feasible than for scars localized in the optical zone.[18] Therefore, the visual acuity after the correction with the CLs was better on the left eye than on the right eye.

The improvement of the patient's visual acuity with contact lens wear far exceeded the straylight. Using the trial lenses, the BCVA improved from 6/30 to 6/15 on the right eye and from 6/15 to 6/7.5 on the left eye. Although visual acuity of 6/6 was not achieved, the patient was satisfied with the improvement. RGP CLs remain a clinically useful treatment option in most patients with corneal scars.

Conclusion

With proper fitting, rigid gas permeable contact lens can be a treatment option in improving the visual acuity for patients with corneal scars, thus helping to further delay surgical treatment and improve patient's quality of life. Nonetheless, careful evaluation of the eye condition with corneal scars before deciding to treat with contact lens is necessary to assure that there is neither active infection nor inflammation.

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