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Case Report

Enhancing Vision Post Penetrating Keratoplasty with Corneo Scleral Contact Lenses

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Abstract

Purpose: To investigate the efficacy of 14.50 mm Corneo-Scleral Lenses in enhancing visual function following Penetrating Keratoplasty.

Case Presentation: Two adolescent patients who had undergone penetrating or lamellar keratoplasty within the past year received treatment with 14.50mm Mc-Asfeer corneo-scleral lenses. Their progress in best corrected visual acuity was monitored following the treatment.

Result: The maximum keratometry value of patients A and B were 54.64 D and 52.36 D on their first visit to our clinic, respectively. Both patients were successfully fit with Mc-Asfeer corneo-scleral lens, showing adequate central corneal clearance of about 320µm (Patient A) and 210µm (Patient B) with no corneal touch on AS-OCT and sufficient limbal clearance of about 120µm with good edge clearance. After the lens insertion, BCVA improved to 6/6. The patient reported an immediate improvement in visual quality and a reduction in ghosting. Subjective comfort was also noted, with no significant discomfort.

Conclusion: This case report demonstrates the effective adaptation of a Corneo-Scleral contact lens in a patient's post-keratoplasty. Corneo-Scleral lenses emerge as a valuable choice for enhancing vision in individuals with irregular corneal surfaces post-keratoplasty, warranting consideration in visual rehabilitation strategies.

Keywords: Keratoplasty; High Astigmatism; Scleral Contact Lens

Introduction

Keratoplasty, either penetrating or lamellar, has many indications that are mostly optical. Management of highly irregular corneas, such as advanced stages of keratoconus or a repaired cornea after full-thickness laceration, is challenging, with few other options available other than keratoplasty [1]. Unfortunately, the unaided visual result of keratoplasty in a significant percentage of these patients is still far from satisfactory. Up to 4 diopter (and even more) astigmatism, both regular and irregular, is very common. McAfeer corneo-scleral GP Lens (Silver Line Laboratories), with their potential to vault the whole cornea, can correct refractive errors and even many higher-order aberrations resulting from the irregularity of the anterior corneal surface in challenging situations such as advanced keratoconus and post-PK patients [2]. Fitting these lenses is relatively easy, and because of their large diameter (12.50–14.50 mm), they are very well-centered in the eye and usually well-tolerated [3]. Here we reported the results of corneo-scleral lenses for correcting unsatisfactory vision and comfort in post-corneal graft patients. The study protocol was approved by the Research Management Committee of the Himalaya Eye Hospital. Informed consent was obtained from both patients to publish their case details and associated images.

Case Presentation

Patient A - 25 years old patient

A 25-year-old male had a history of advanced keratoconus followed by full-thickness corneal grafts with deep anterior lamellar grafts (DALK). Post-surgery, the patient experienced significant

visual distortions due to high irregular astigmatism. Standard eyeglasses and soft contact lenses provided minimal visual improvement. The preoperative uncorrected visual acuity (UCVA) was 6/36, and the best-corrected visual acuity (BSCVA) was 6/18, with a subjective refraction of -3.50Ds/-7.00Dc@015. Figure 1A shows the corneal topography of his right eye using the Topcon CA-800 Corneal Analyzer. Simulated keratometry (simK in D) was assessed at the flattest and steepest meridians. His simK values were 48.09D at 018 and 54.64D at 108, resulting in approximately 7 D of astigmatism between the flat and Steep meridian. To address the post-keratoplasty refractive error, the McAfeer corneo-scleral contact lens was fitted (Figure 1). Boston® XO2 (hexafocon B) is a gas-permeable contact lens material composed of siloxanyl fluoromethacrylate copolymer with a DK value of 141. A 7.00/4.58/-2.50/14.50mm base curve lens was finalized based on the manufacturer guidelines as provided by Silver Line laboratories. A lens diameter of 14.50 mm, large enough to vault over his white-to-white without corneal apical or limbal touch, was selected. The corneal apical clearance was measured after 1 hour of lens insertion by observing the space between the anterior surface of the cornea and the posterior surface of the lens on a slit lamp with fluorescein. The lens was moved slightly (about 0.5 mm) and pushed up by slightly pressing conjunctiva with a finger. Good limbal clearance (approximately 120µm) was evaluated by noting fluorescein extending beyond the limbus, and scleral landing zones were assessed subjectively at the slit lamp by diffuse white light for impingement or blanching of blood vessels. Then the optimum clearance at around 320 µm after lens settling was confirmed using AS-OCT (OptoVue Avanti OCT-A) (Figure 1). After fitting the lens, the patient was asked to visit on the first day, 1 week, and 1 month consecutively. Fortunately, there were no symptoms of redness or discomfort, and it was recommended to wear it for up to 8 hours per day. At the 1-month post-lens visit, his visual acuity was found to be 20/20 with adequate central clearance, limbal clearance, and edge alignment. Finally, consecutive follow-up assessments show how corneal lens fitting has enabled Patient A to achieve improved visual acuity and enhanced quality of life.

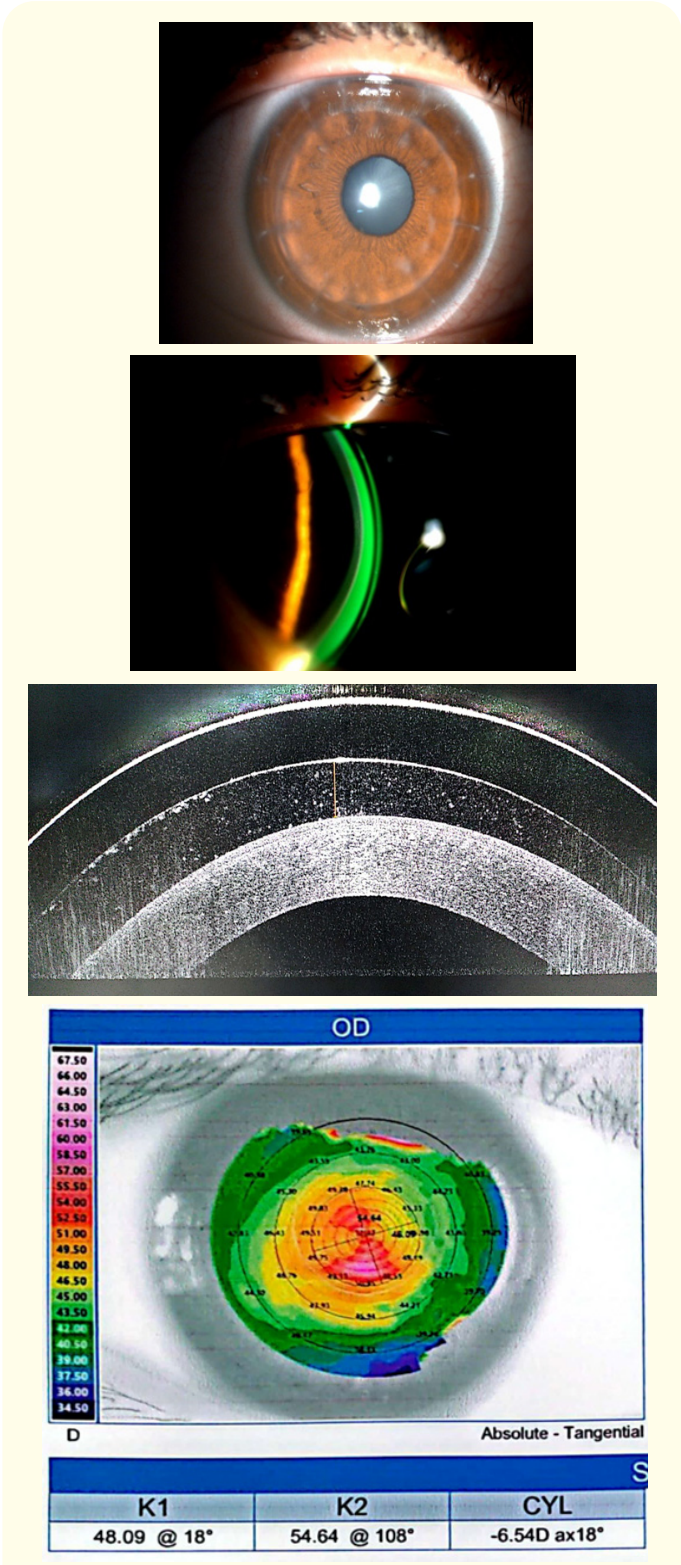
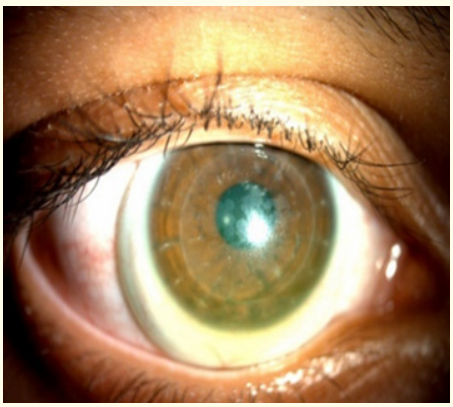


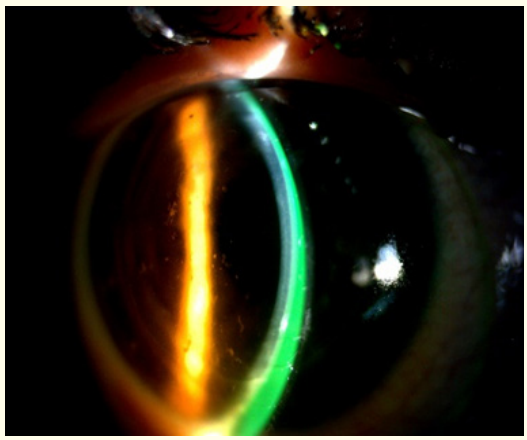
Figure 1: Cornea of the patient A after full thickness keratoplasty, central corneal vaulting (320µm), corneal topography (before fitting) and OCT image after fitting Mc-Asfeer Corneo-Scleral contact lens (7.00/4.58/-2.50/14.50mm) respectively.

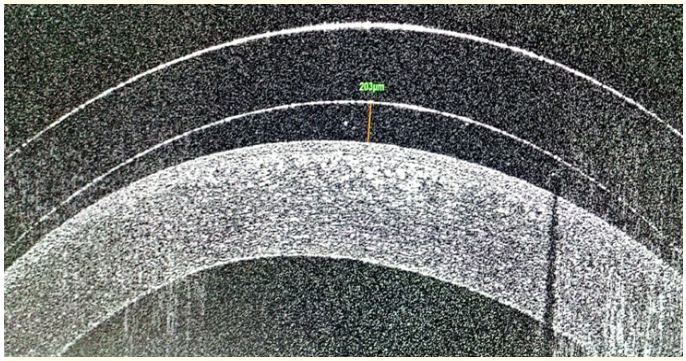
Patient B - 28 years old patient

A 28-year-old female underwent lamellar keratoplasty to treat corneal scarring secondary to an ocular injury. After surgery, the patient exhibited irregular astigmatism and high anisometropia. Her reliance on glasses and standard soft contact lenses for vision correction proved unsatisfactory. The preoperative uncorrected

visual acuity (UCVA) was 6/24, and the best-corrected visual acuity (BSCVA) was 6/12, with a subjective refraction of -4.50Ds/-6.50Dc@045. Figure 2A shows the corneal topography of her right eye using the Topcon CA-800 Corneal Analyzer, resulting in approximately 7 D of astigmatism between the flat and Steep meridian. In order to correct the post-refractive error, the McAfeer corneo-scleral contact lens was fitted (Figure 2) with lens material composed of siloxanyl fluoromethacrylate copolymer with a DK value of 141. An 6.90/4.74/-3.50/14.50mm base curve lens was finalized based on the manufacturer guidelines as provided by Silver Line laboratories. Then the optimum clearance at around 210 µm after lens settling was confirmed using AS-OCT (OptoVue Avanti OCT-A) (Figure 2). Good limbal clearance (approximately 120µm) was evaluated by noting fluorescein extending beyond the limbus, and scleral landing zones were assessed subjectively at the slit lamp by diffuse white light for impingement or blanching of blood vessels. After fitting the lens, the patient was asked to visit on the first day, 1 week, and 1 month consecutively. Fortunately, there were no symptoms of redness or discomfort, and it was recommended to wear it for up to 8 hours per day. At the 1-month post-lens visit, his visual acuity was found to be 20/20 with adequate central clearance, limbal clearance, and edge alignment. These case descriptions within the case series demonstrate the applicability and benefits of corneo-scleral contact lenses in achieving improved visual rehabilitation and quality of life for patients following PK.







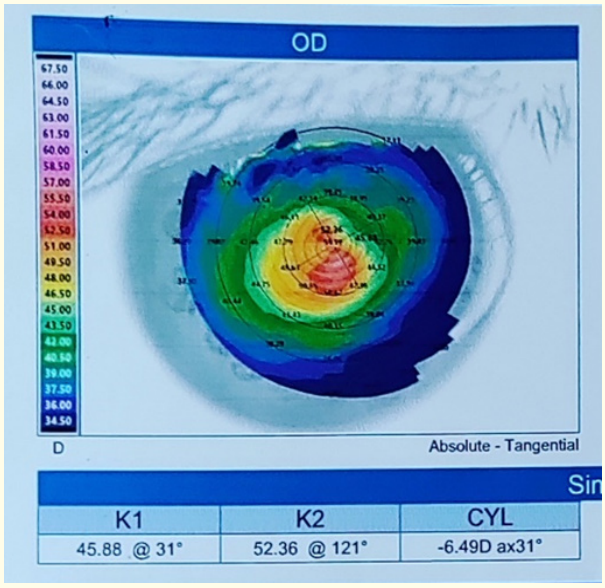


Figure 2: Cornea of the patient B after Deep anterior lamellar keratoplasty (DALK) in corneal scar, central corneal vaulting (210µm), corneal topography (before fitting) and OCT image after fitting McAsfeer Corneo-Scleral contact lens (6.90/4.74/-3.50/14.50mm) respectively.

Discussion

Penetrating keratoplasty (PK) is a surgical procedure often employed to correct vision impairment caused by corneal diseases or damage. While PK can restore visual acuity, many patients still experience refractive errors or irregular astigmatism post-surgery, leading to suboptimal vision. Corneo-scleral contact lenses have emerged as a promising solution to address these challenges and enhance visual outcomes in patients following PK. This discussion explores the application and effectiveness of corneo-scleral contact lenses in improving vision post-PK. Most additional investigations found that irregular astigmatism could be adequately treated with scleral lenses, which had a diameter of 15 to 24 mm [5,6]. Additionally, wearing scleral lens has recently improved vision-related quality of life in patients with uneven corneas and keratoconus. Scleral lenses have recently been shown to produce good visual outcomes for astigmatism following PK. More than five lines of improvement from BCVA with spectacles were demonstrated by Alipour., *et al*. (2015) when eyes were fitted with scleral lens after PK. Barnett., *et al*. reported success fitting lenses with a diameter range of 15.6 to 18.4 mm for post-PK eyes and achieved functional visual acuity of 20/40 or better. The outcomes of this study, where Corneo-Scleral lenses significantly improved the best-corrected visual acuity (BCVA) in post-keratoplasty patients, are consistent with and supported by existing literature on the topic [2]. The observed improvement in BCVA with corneal lenses aligns with numerous studies that have investigated the use of specialty contact lenses in post-keratoplasty patients [1,5]. Corneo-scleral lenses, with their ability to vault the cornea, can effectively address irregular corneal surfaces and high-order aberrations. This outcome is in agreement with findings in studies conducted by Romero-Jiménez., *et al*. (2017) and Penbe A., *et al*. (2021), which also reported significant improvements in visual acuity following the use of scleral lenses post-keratoplasty [5,6]. The achievement of an ideal lens that fits all eyes included in this study reinforces the idea that corneal lenses can offer a comfortable and stable visual correction option for post-keratoplasty patients. This is corroborated by the work of Romero-Jiménez., *et al*. (2010), which found that properly fitted Corneo-Scleral lenses provided optimal comfort and lens centration in keratoconus eyes.

Conclusion

Corneo-scleral contact lenses represent a valuable tool in enhancing vision and improving quality of life for patients undergoing PK. The findings of this study, highlighting the substantial enhancement in best-corrected visual acuity (BCVA) achieved through the application of corneo-scleral lenses in two distinct post-keratoplasty cases, resonate with a growing body of literature in this field. Patient A, who had a history of advanced keratoconus and full-thickness corneal grafts with deep anterior lamellar grafts (DALK), and Patient B, with a history of superficial traumatic corneal scarring followed by anterior lamellar grafts (DALK). Continued research and clinical experience will further refine the application of scleral lenses in optimizing post-PK visual rehabilitation, ensuring better outcomes for patients with corneal pathology.

Ethical Approval

Ethical approval was taken from Himalaya Eye Hospital.

Consent

Written informed consent was obtained from the patient for the publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Sources of Funding

No funding was received for the study.

Authors' Contribution

A.S. and M.M. conceptualized the study, reviewed and A.P. and B.G. edited the manuscript, and were in charge of the case.

Conflict of Interest Disclosure

Authors have no conflict of interest to declare.

Guarantor

Arjun Sapkota.

Data Availability Statement

All the required data are available in the manuscript itself.

Acknowledgments

None.

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