CASE REPORT

Implantable collamer lens in a case of corneal scar with anisometropic amblyopia in an adult: an expanded indication

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SUMMARY

A 35-year-old man, a unilateral high myope with corneal scarring, presented for evaluation. He had a stromal scar that started temporally, traversed along the pupillary zone partially and extended across the horizontal diameter of the cornea. The Descemet's membrane appeared intact even though the scar was extending into deep stroma towards the nasal end, as seen in the optical coherence tomography image. The patient had an uncorrected distance visual acuity (UDVA) of 4/60 OD, which improved with a refraction of −9.0 DS/−1.50 DC at 15 to 6/18p and 6/6p OS. He underwent an uneventful toric implantable collamer lens (ICL) implantation of −15.0 D/−2.0 D at 102 after preoperative yttrium–aluminium–garnet (YAG) laser iridotomy in the right eye. The postoperative UDVA and corrected distance visual acuity for the right eye were 6/12 and 6/9p (with a refraction of +0.50 D/−0.50 D at 85), respectively. The corneal scar and topography were stable. This case reports an expanded indication for toric ICL in cases with corneal scar/opacity but good spectacle corrected visual acuity.

BACKGROUND

Unilateral high myopia with resultant anisometric amblyopia is a rare condition that can develop in cases with corneal opacification or scarring existing from childhood.[1–3] If the corneal scar causes a severe irregular astigmatism, rigid contact lenses or lamellar corneal transplants are the treatment options.[4] However, cases with milder scars and good spectacle visual acuity need a more conservative approach. Implantable collamer lenses (ICL) are a safe and effective method for elective vision correction for high myopia.[5 6] They have been used in clear cornea and mild-to-moderate stable keratoconus.[7 8] However, there are no reported cases of ICL implantation in cases of corneal scarring. We summarise our approach, management and long-term follow-up of this expanded indication of ICL.

CASE PRESENTATION

A 35-year-old man was referred to us with a diagnosis of unilateral high myopia and corneal opacity in the right eye. There was a history of high but stable refractive error in the right eye. The patient was intolerant to contact lenses and had tried them unsuccessfully for short periods. Therefore, he was looking for a more long-term solution. He had a stromal scar that started temporally, traversed along the pupillary zone partially and extended across the horizontal diameter of the cornea (figure 1A). The Descemet's membrane appeared intact even though the scar was extending into deep stroma towards the nasal end, as seen in the optical coherence tomography (OCT) image (figure 1B). The anterior segment was otherwise unremarkable. Retrospective history was positive for probable ocular trauma at the age of 3 years.

On examination, the patient had an uncorrected distance visual acuity (UDVA) of 4/60 OD and 6/6p OS, which improved with a refraction of −9.0 DS/−1.50 DC at 15 to 6/18p in OD and −0.5 DS to 6/6 in OS. On a soft contact lens trial, there was no diplopia and patient was satisfied with the visual acuity in simulated day and night conditions.

INVESTIGATIONS

The patient was further followed for 6 months to evaluate any change in corneal status before planning intervention. The corneal parameters and refraction were stable. Preoperative Scheimpflug

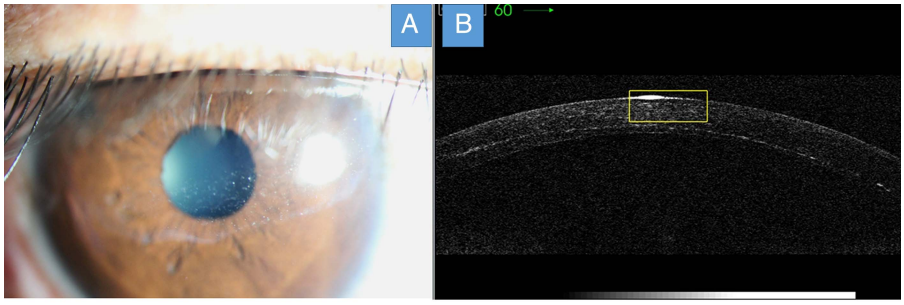

Figure 1 (A) Slit lamp photograph of the cornea showing the horizontal scar traversing the pupillary axis. (B) Optical coherence tomography of the cornea showing the level of the linear scar.

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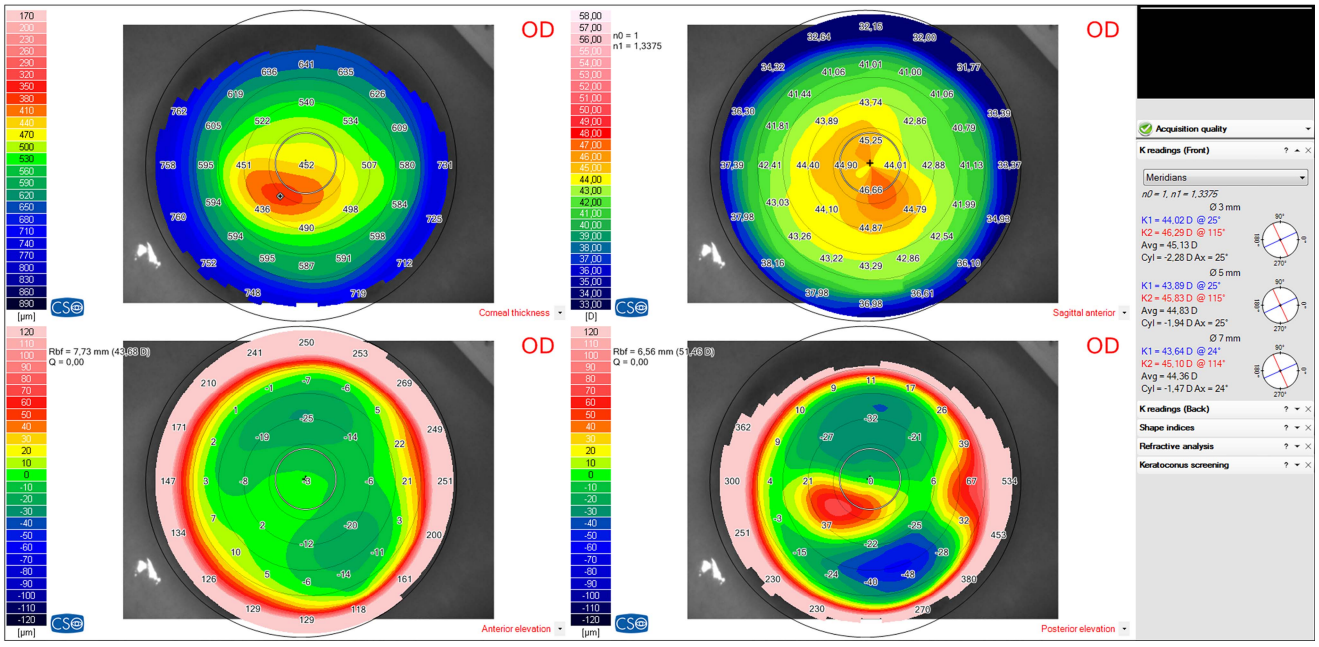

Figure 2 Preoperative corneal topography of the right eye showing the corneal thickness, sagittal (axial), anterior elevation and posterior elevation scans.

imaging (Sirius, Costruzione Strumenti Oftalmici, Italy) showed the simulated K1/K2 to be 44.0 D/46.3 D in OD and 42.6 D/43.3 D in OS (figure 2 OD and figure 3 OS). The central corneal thickness and minimal corneal thickness were 452/385µ OD and 465/466µ OS (figure 2 OD, figure 3 OS). However, ultrasound (US) pachymetry confirmed the pachymetry to be 455 µ in the corresponding area shown as thinnest in the right eye. Cases with corneal haze tend to show a false lower pachymetry on computerised optical pachymetry methods with automated computing of thickness.[9] Therefore, US pachymetry tends to be more reliable in such cases. Specular count was 2406 cells/mm^2 OD and 2332 cells/mm^2 OS. Non-contact biometry (Lenstar LS 900, Haag Streit AG, Switzerland) showed an axial length of 28.22 mm OD and 24.35 mm OS, confirming axial myopia in the right eye. We normally measure the white-to-white with three different methods and then look for consistency. The methods used are Lenstar's white-to-white diameter output, Sirius topography's direct image capture and manual measurement by callipers on the slit lamp. The three results gave us a consistent white-to-white of 12.25, 12.26 and 12.3 mm, respectively. The scar did not interfere with identifying the white-to-white diameter. Anterior chamber depth (endothelium to anterior lens surface) was measured as 3.07 mm in OD and 2.9 mm in OS by the non-contact biometry and the

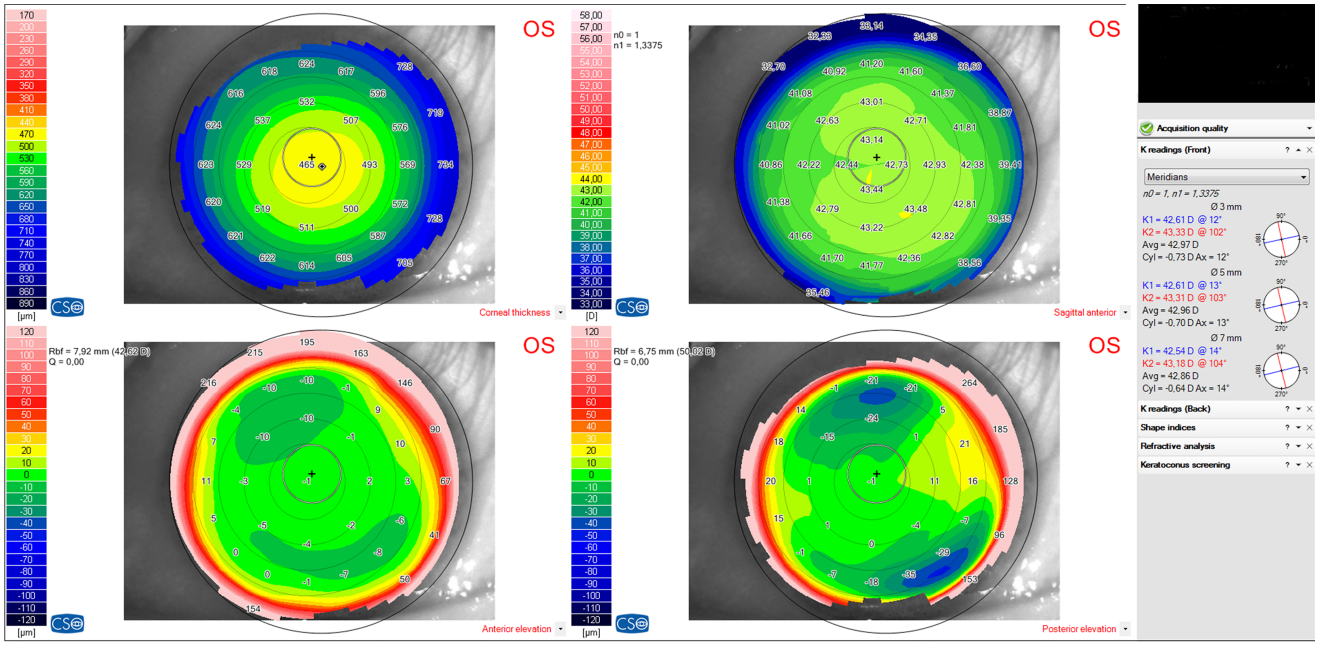

Figure 3 Corneal topography of the left eye showing the corneal thickness, sagittal (axial), anterior elevation and posterior elevation scans.

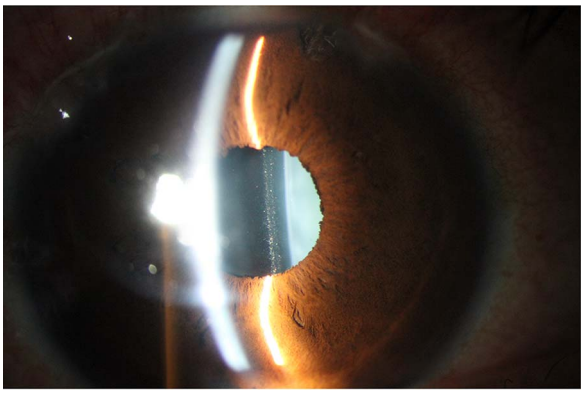

Figure 4 One-year postoperative slit lamp photograph showing the implantable collamer lens in situ. The corneal scar is more prominently seen temporal to the slit beam.

Scheimpflug imaging. Gonioscopy and dilated retinal evaluation were normal OU.

TREATMENT

The patient was counselled about options, including contact lens prescription and surgery. As he was intolerant to contact lenses, he was interested in surgical correction. In view of the corneal scar and high myopia with only astigmatism, a toric ICL was considered.

Two neodymium: yttrium–aluminium–garnet laser (Nd:YAG) iridotomies (superotemporal and superonasal) were performed in a single sitting 2 weeks before the surgery.

The desired power and size of the toric ICL were computed using online calculation software by STAAR Surgical (https://ocos.staarag.ch/, STAAR Surgical Company AG, Switzerland). This proprietary software uses the white-to-white and anterior chamber depth to calculate the ICL diameter. A toric ICL of −15.0 D/−2.0 D at 102 (optic diameter 4.6–5.5 mm, overall diameter 12.5 mm) was selected for the implantation (Visian ICL, TICM125V4, STAAR Surgical Company AG, Switzerland). Preoperatively, the horizontal axis and axis of implantation were marked using a sterile surgical marking pen on a slit lamp in sitting position. After this the patient was shifted to the operating table and prepared for surgery under topical anaesthesia.

The ICL cartridge was lubricated with hydroxypropyl methylcellulose (HPMC) 2% (Ocucoat, Bausch and Lomb, New York, USA). The ICL was taken out of the packing and loaded making sure to maintain the vault anterior and to keep the alignment marks visible. The ICL was pulled up into the cartridge using Zaldivar front loading forceps (STAAR Surgical, California, USA). The assembly was then loaded into the injector and the injector-cartridge system was locked and made ready for use. Two 1.2 mm (one superonasal and one superotemporal) incisions were made in the clear cornea. HPMC 2% was injected to inflate the chamber and a triplanar 3 mm main incision was made in the clear cornea superiorly. The ICL was slowly injected into the anterior chamber maintaining its orientation and ensuring that it was opening correctly. Then the ICL was rotated into desired position as shown by the alignment diagrams using Vukich's ICL manipulator. The ICL's footplates were then tucked below the iris avoiding contact with the corneal endothelium or the crystalline lens. Viscoelastic was aspirated gently using a bimanual aspiration system, the ICL orientation rechecked and intracameral miotic carabachol 0.01% (Omnichol, HP, India) was injected. The wounds were hydrated and one 10-0 monofilament nylon suture was placed in the main incision. Oral acetazolamide 250 mg was given postoperatively. Topical G moxifloxacin 0.3% (Vigamox, Alcon, Texas, USA) four times a day, G prednisolone drops (Predforte 1%, Allergan, California, USA) six times a day, G CMC 0.5% (Refresh Plus, Allergan, California, USA) six times a day and G timolol maleate 0.5% (Cusimolol, Alcon Cusi SA, Spain) twice a day were given. The medications were tapered over 3 weeks.

OUTCOME AND FOLLOW-UP

The UDVA improved to 20/40 by the 1-week follow-up. Further refraction of +1.0 D/−0.50 D at 95 improved the corrected distance visual acuity (CDVA) to 20/32. There was no diplopia. There was a good ICL vault. On 1-year follow-up, the ICL was well positioned (figure 4). The scar was stable and the vault was maintained as confirmed on the OCT scans (Spectralis, Heidelberg Engineering GmbH, Germany; figure 5). There was

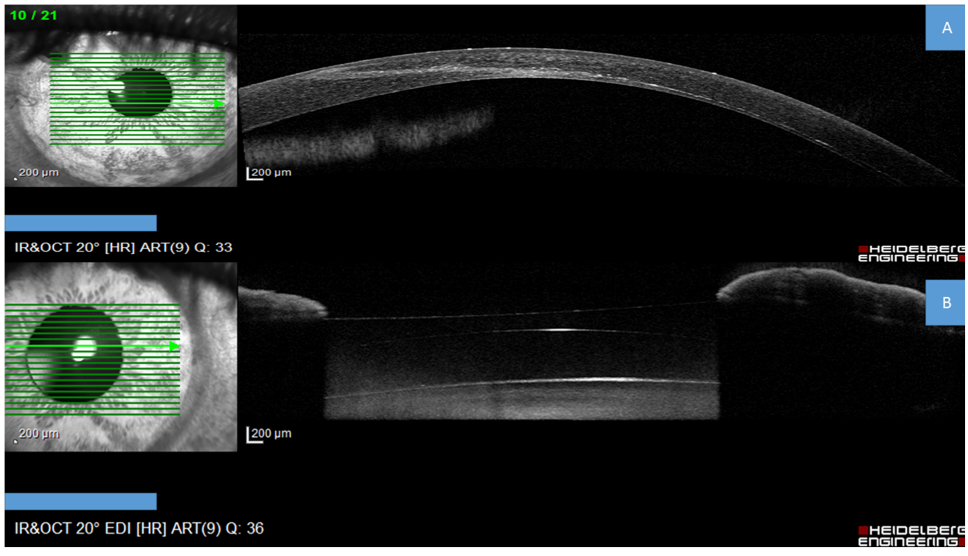

Figure 5 One-year postoperative optical coherence tomography scans demonstrating the corneal scar (A) and the postoperative implantable collamer lens vault (B).

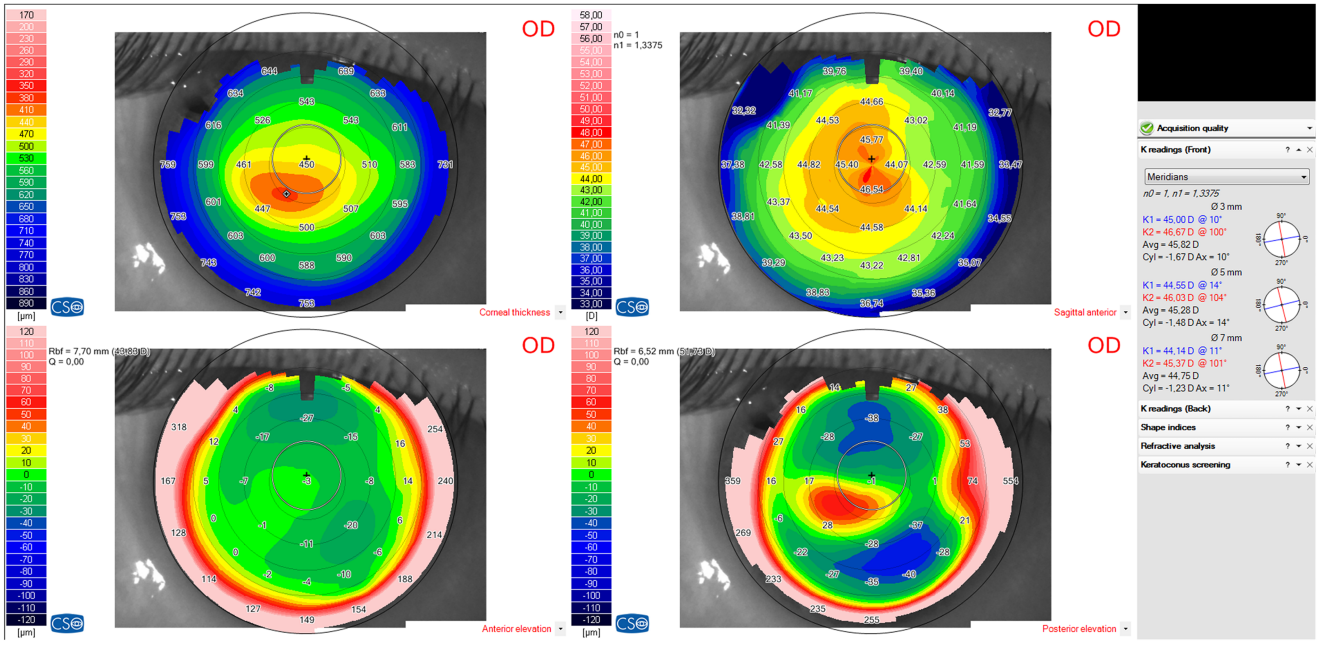

Figure 6 Postoperative 1-year corneal topography of the right eye showing the corneal thickness, sagittal (axial), anterior elevation and posterior elevation scans. All the four maps showing stable parameters.

no significant change in the specular count (2398 cells/mm^2 OD and 2338 cells/mm^2 OS). The topographic parameters were stable with no evidence of any deterioration in either eye (figures 6 and 7). The UDVA and CDVA were 20/40 and 20/32 (with a refraction of +0.50 D/−0.50 D at 85) in OD and 20/25 and 20/20 (with a refraction of −0.5 D) in OS, respectively.

DISCUSSION

Long-term follow-up with implantable posterior chamber collamer lenses has shown a good safety profile.[5 6] Although initially meant only for high myopia and astigmatism, the ICL has been successfully used in cases of stable keratoconus with a relatively regular cornea.[7 8] In our experience with ICL implantation in keratoconus, we have noticed that patients who achieve a good spectacle corrected visual acuity and quality would benefit with ICL implantation. Cases who have the cornea too aberrated to have an improvement in CDVA with only rigid/specialised contact lenses for keratoconus, will not improve with ICL implantation. Similar principles have been noted by other authors.[10 11]

To the best of our knowledge, there is no other published report of ICL implantation in a case with corneal opacity and associated high anisometropia. Therefore, we used the principles and experience of ICL implantation in irregular (keratoconic)

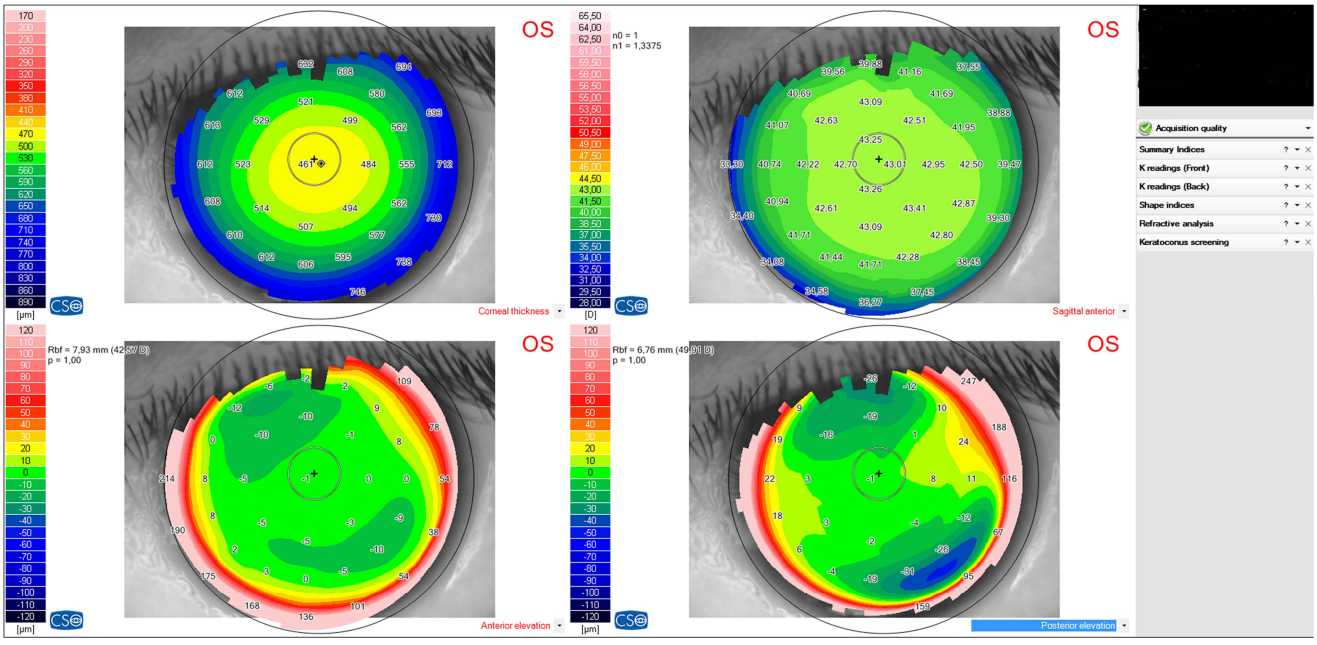

Figure 7 One-year follow-up corneal topography of the left eye (unoperated) showing the corneal thickness, sagittal (axial), anterior elevation and posterior elevation scans. All the four maps showing stable parameters.

corneas as described above. The patient had a good CDVA with glass correction. Owing to the severe anisokenia, he was not able to use binocular vision with glass correction. Therefore a trial soft contact lens was used on the right eye to simulate his postoperative vision and assess his comfort with binocular vision. We proceeded for the surgery only after the patient was comfortable with his simulated outcome. The increase in UDVA was satisfactory and the long-term stability of results has shown the feasibility of ICL implantation in this expanded indication.

In cases with a high cylinder, the possibility of intraoperative or postoperative rotation of the ICL is existent. The steps to prevent a wrong axis include the following: the axis of implantation and the horizontal axis should be marked meticulously in a sitting position on a slit lamp. Intraoperatively, the implantation diagram should be checked before and after rotating the ICL into correct position. The viscoelastic should be removed meticulously, yet gently, to ensure complete removal without rotating the ICL. We routinely check the ICL's alignment marks, before using intracameral miotic drops, to recheck the alignment. For postoperative evaluation, any astigmatism not accountable by the change in corneal topography due to incision is either residual or due to misalignment. Retinoscopic refraction should be performed on follow-up visits and a dilated evaluation of the ICL position can be useful to rule out astigmatism due to a rotated ICL. We did not encounter a rotation of ICL in our case and the refraction remained stable over the 1 year of postoperative follow-up. The results with toric ICL have been very satisfying in the literature regarding rotational stability and refraction.[7 12 13] However, ensuring the above discussed steps can further reduce the risk of rotation in toric ICL.

This treatment is also less invasive than a lamellar corneal transplantation and clear lens extraction, which was another possible option in this case. Another option would have been a stepwise phototherapeutic and photorefractive keratectomy. It has also been shown that ICL implantation is a better choice in cases with high myopia compared to excimer ablation, thus making it the preferred method for elective vision correction in this situation.[5 6]

However, there are certain words of caution. Our case had a stable corneal status and we documented it further over a 6-month follow-up. In cases with evolving scars and changing refractive error, refractive surgery should not be performed. Further, in cases with scar involving the endothelium, we would recommend against intraocular interventions such as ICL. Finally, if the patient does not have good monocular visual acuity with spectacle correction in various illumination conditions, and dynamic and static conditions, or has difficulty in binocular adjustment, as seen on soft contact lens simulation, he/she would not be happy with ICL implantation.

To conclude, this case has shown that ICL appears to be a safe and effective method of visual correction in cases with moderate scarring of cornea and high myopia.

Learning points

- Patients with corneal scars and refractive error can be given the option of implantable collamer lens (ICL) implantation for improvement of unaided vision.
- Stable refraction and good corrected distance visual acuity with glasses are both essential prognostic factors for cases with corneal scarring for ICL implantation.
- A thorough preoperative assessment of diplopia, preferably with trial contact lens rather than spectacles, and in simulated day and night conditions, would pre-empt any postoperative surprise.

Contributors GP, DS and KA were involved in the conception and design. GP, DS and JK were involved in data acquisition, analysis and interpretation. All four authors were involved in drafting the article, revising it critically and in the final approval of the version published.

Competing interests None.

Patient consent Obtained.

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REFERENCES

1 Gee SS, Tabbara KF. Increase in ocular axial length in patients with corneal opacification. *Ophthalmology* 1988;95:1276–8.
2 Tabbara KF, Al-Omar OM, El-Sheikh HF, *et al*. The long term effects of unilateral corneal scars. *Doc Ophthalmol* 1999;98:267–72.
3 Wiesel TN, Raviola E. Increase in axial length of the macaque monkey eye after corneal opacification. *Invest Ophthalmol Vis Sci* 1979;18:1232–6.
4 Singh K, Jain D, Teli K. Rehabilitation of vision disabling corneal opacities: is there hope without corneal transplant? *Cont Lens Anterior Eye* 2013;36:74–9.
5 Huang D, Schallhorn SC, Sugar A, *et al*. Phakic intraocular lens implantation for the correction of myopia: a report by the American Academy of Ophthalmology. *Ophthalmology* 2009;116:2244–58.
6 Barsam A, Allan BD. Excimer laser refractive surgery versus Phakic intraocular lenses for the correction of moderate to high myopia. *Cochrane Database Syst Rev* 2010;(5):CD007679.
7 Kamiya K, Shimizu K, Kobashi H, *et al*. Three-year follow-up of posterior chamber toric phakic intraocular lens implantation for the correction of high myopic astigmatism in eyes with keratoconus. *Br J Ophthalmol* 2015;99:177–83.
8 Shafik Shaheen M, El-Kateb M, El-Samadouny MA, *et al*. Evaluation of a toric implantable collamer lens after corneal collagen crosslinking in treatment of early-stage keratoconus: 3-year follow-up. *Cornea* 2014;33:475–80.
9 Boscia F, La Tegola MG, Alessio G, *et al*. Accuracy of Orbscan optical pachymetry in corneas with haze. *J Cataract Refract Surg* 2002;28:253–8.
10 Kummelil MK, Hemamalini MS, Bhagali R, *et al*. Toric implantable collamer lens for keratoconus. *Indian J Ophthalmol* 2013;61:456–60.
11 Park SW, Kim MK, Wee WR, *et al*. Partial visual rehabilitation using a toric implantable collamer lens in a patient with keratoconus: a case report with 20 months of follow-up. *Korean J Ophthalmol* 2013;27:211–14.
12 Park SC, Kwun YK, Chung ES, *et al*. Postoperative astigmatism and axis stability after implantation of the STAAR toric implantable collamer lens. *J Refract Surg* 2009;25:403–9.
13 Liu TX, Luo X. Stability of axis and patient satisfaction after toric implantable collamer lens implantation for myopic astigmatism. *Pak J Med Sci* 2013;29:1371–4.