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Case report

Scleral lens after intracorneal ring segments in patients with keratoconus

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ABSTRACT

Background: To report the use of scleral lens (ScCL) to improve vision in patients having keratoconus who had intracorneal ring segment (ICRS) surgery.
Methods: Two eyes of two keratoconus patients fitted with ScCL (PROSE − prosthetic replacement of the ocular surface ecosystem, USA) after having undergone ICRS surgery are reported as noncomparative interventional case series. The ICRS implanted were INTACs and kerarings. Indications, visual acuity with ScCL, complications and follow-up are reported.
Results: Case 1 underwent ScCL trial as he was referred for keratoplasty for being contact lens intolerant after ICRS surgery. Case 2 was intolerant to both corneal rigid gas permeable (RGP) lens and soft contact lens (SCL). 18.5 and 18 mm diameter ScCLs were dispensed to Case 1 and 2 respectively. The ScCLs had adequate corneal clearance with no corneal touch. There was no staining of the cornea or vascularization with the lens use. Case 1 complained of double images during trial with different Front surface eccentricity (FSE). A ScCL that did not cause diplopia was ordered. At four months of lens wear, the patient had diplopia with ScCL, which cleared when second lens with changed FSE was dispensed. Case 2 used SCL for five years before ScCL was fitted. He used the same ScCLs for five years. ScCL use resulted in improved comfort and visual acuity of 20/20. No complications were noted.
Conclusions: ScCL may be tried in patients who have ICRS and are intolerant to corneal RGP or SCL and before subjecting such patients to keratoplasty.

1. Introduction

Intracorneal ring segments (ICRSs) have shown to improve visual acuity in mild to moderate keratoconus and in those patients who have contact lens intolerance [1,2]. Various studies have shown improved corneal topography, improved uncorrected visual acuity (UCVA), more so in patients with mild to moderate keratoconus compared to severe keratoconus with ICRS [2,3]. However, ICRS may not improve vision in patients having advanced keratoconus and may pose a challenge to the treating clinician. Although ICRS may delay or eliminate the need for keratoplasty, a contact lens may be required for the best visual outcome after ICRS. However, fitting contact lens after ICRS implantation is challenging as the corneal topography alters [4]. Lens centration may become a problem with altered corneal topography [4]. Patients with poor visual outcome after ICRS surgery are managed with contact lenses in the postoperative period. The contact lenses used may be soft contact lenses (SCL) [5], soft toric lenses [6], rigid gas permeable (RGP) lenses[5], piggy back contact lenses (PBCL) [7] and scleral lenses (ScCL) [8–10]. Carrasquillo et al. [11] have shown improved contact lens tolerance in 81% of eyes after ICRS implantation.

A ScCL is a large diameter lens that rests on sclera and does not touch the cornea. [12] Various studies in literature have shown improved visual acuity with ScCL in keratoconus [13–16].

ScCLs are indicated when the patient is contact lens intolerant or visual acuity does not improve with other lenses. This study reports the use of ScCL (PROSE, prosthetic replacement of the ocular surface ecosystem, Needham Heights, MA, USA) in two eyes of two patients who had prior ICRS surgery done, as a noncomparative interventional case series.

2. ScCL fitting

The technique of fitting ScCL and PROSE is described in literature [17]. Three parameters are important while fitting a ScCL: diameter of the lens, vault measured by corneal clearance and the alignment of the haptic or scleral portion with the sclera [17].

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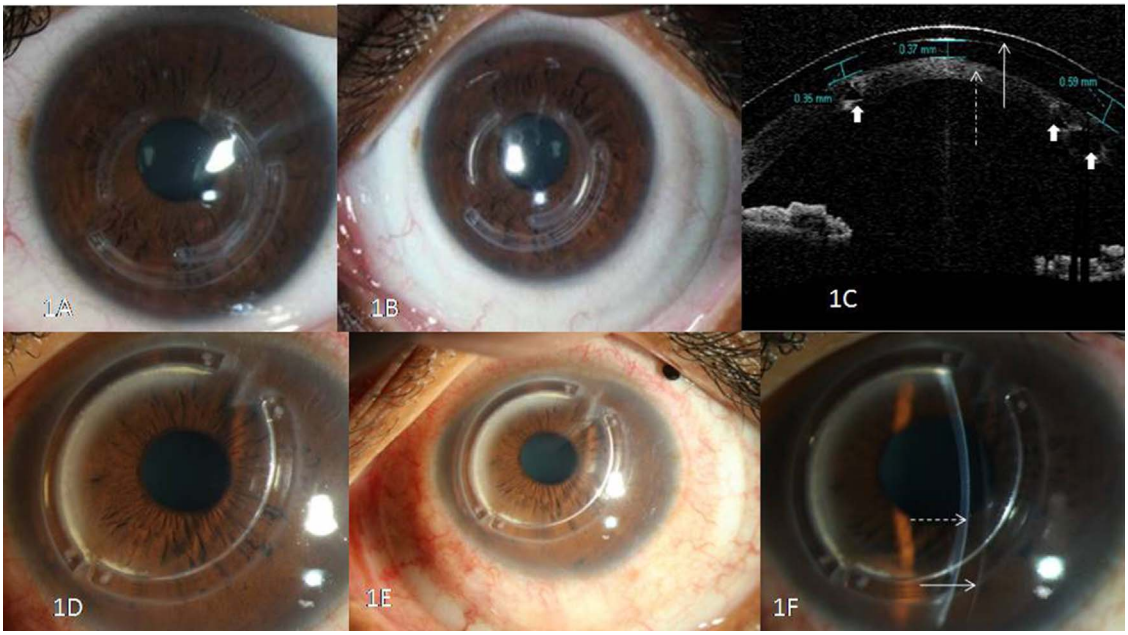

Fig. 1. (A) Case 1–A photograph using diffuse illumination showing three ring segments in the left eye. (B) Case 1–A photograph using diffuse illumination showing 18.5 mm scleral lens in the eye resting on sclera. (C) Case 1–AS-OCT of scleral lens on eye with ICRS. AS-OCT shows that the lens is not touching the cornea centrally as well as in the area of ICRS. The vault is measured with in-built calipers and it is adequate. (Broken arrow shows front surface of cornea. Solid arrow shows back surface of scleral lens. Thick white arrows point to the three black optically empty spaces in cornea due to the presence of ICRS). (D) Case 2–A photograph using diffuse illumination shows intracorneal ring segments with grayish white yellowish lipid deposits around the inner aspect of ring segments. (E) Case 2–A photograph using diffuse illumination showing 18.0 mm scleral lens in the eye resting on sclera. (F) Case 2–A photograph using slit illumination shows corneal clearance with no touch to the cornea (Broken arrow shows front surface of cornea. Solid arrow shows back surface of scleral lens).

Table 1
Parameters of ordered lens.

	Vault	Diameter	Base curve	Power	FSE[a]	Haptic	Toricity	Visual acuity with scleral lens
Case 1 RE (no ICRS)	4.9	18.5	8.2	−1.50	0.6	14.25	0	20/20
LE With ICRS	5	18.5	7.9	0.25	0.300 (later changed to 0.600)	14.25	0	20/20
Case 2 RE (No ICRS)	4.8	18	7.91	−0.37	0.600	16	−0.40@ 90	20/20
Case 2 LE with ICRS	4.7	18	7.91	−0.25	0.600	15.50	−0.25 @ 90°	20/20

The parameters of the ScCL ordered and wore by the patients.
[a] FSE: Front surface eccentricity.

The ScCL is filled with normal or preservative-free saline prior to the insertion in the eye. Care has to be taken not to leave any air bubble in fluid reservoir and if found, the lens is to be removed and reinserted. The corneal clearance is assessed by noting the space between the front surface of the cornea and back surface of the lens on slit-lamp biomicroscopy, with or without instillation of fluorescein or by anterior segment optical coherence tomography (AS-OCT) [18]. The fitting is assessed immediately, at one hour and then after wearing lens for 4 h. The final fitting parameters are decided at the end of 4 h.

Firstly, measurement of visual acuity is done with ScCL including over refraction with loose lens in the trial frame. Slit-lamp biomicroscopy is done to assess the haptic or scleral portion of the lens for the presence of conjunctival indentation or edge lift. The presence of edge lift is indicative of the toric nature of the sclera. The fitter notes the presence or absence of suction felt while removing the lens. Fluorescein staining of the conjunctiva is done immediately after the lens is removed. Conjunctival staining should be negative. Presence of conjunctival staining indicates either a toric sclera (staining may be in one quadrant or two opposite quadrants) or too tight a lens on the eye (360° staining of conjunctiva). In such scenarios, either a lens with flatter haptic and toricity in presence of toric sclera or a lens with flatter haptic has to be tried. ScCL comes with various front surface eccentricity (FSE) values: FSE value of zero indicates a spherical lens and as the value increases, the front surface of the lenses becomes flatter in the periphery. A lens of 0.3 FSE has more curvature in the periphery as compared to a lens of 0.6 or 0.8, which is flatter in the periphery. [19] One can try lenses with different FSE values to assess the improvement in visual acuity.

2.1. Case 1

A 22-year-old man presented to us with bilateral keratoconus for which collagen cross-linking was done a year earlier for both eyes and ICRS surgery was done in left eye three years prior to presentation. He complained of diminished vision in both eyes and intolerance to corneal RGP contact lenses. His UCVA was 20/30 in right eye. There was a scissor's reflex on retinoscopy in both eyes. Right eye retinoscopy value was of −1.00DS/-4.00DCyl @ 30° and over-refraction was plano. UCVA of left eye was 20/200 and visual acuity improved to 20/60 with pinhole. The retinoscopy value in the left eye was −10DS/-4.00DCyl @ 150°. However, the acceptance in left eye was −10.00DS and visual acuity improved to 20/160.

Slit-lamp biomicroscopy of both eyes revealed corneal ectasia, thinning and presence of Vogt's striae. Fig. 1A shows ICRS present in the patient's left eye. Corneal topography with Orbscan IIz shows sim k values of 46.9 D/44.3 D @ 24° in right eye and 55.2 D/51.1 D @ 12° in left eye.

The patient first underwent corneal RGP trial in both eyes with which the visual acuity was 20/25. The patient had discomfort with RGP lenses and ScCL was fitted for both the eyes. A ScCL of 18.5 mm