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Case report

# Scleral lenses in the treatment of post-LASIK ectasia and superficial neovascularization of intrastromal corneal ring segments

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ABSTRACT

*Objective:* This case report aims to explore the use of scleral lenses for the treatment of ocular and visual complications in an adult patient presenting with post-LASIK (Laser-Assisted in situ Keratomileusis) ectasia in both eyes with cross-linking in the right eye and intrastromal corneal ring segments (ICRS; Intacs, Addition Technology, Fremont, CA) in the left eye.
*Methods:* Following a comprehensive eye exam and specific testing for contact lens fitting, scleral lenses were fitted with success in both eyes and dispensed. Due to progressive fibrosis and neovascularization of the inferior ICRS in the left eye, the inferior ICRS was removed and scleral lenses were refit with success.
*Results:* Prescribed scleral lenses helped the patient achieve optimal visual correction (20/20) as well as ocular protection of the cornea.
*Conclusion:* Post-LASIK ectasia is a common finding among contact lens specialists today. When ICRS surgery is involved, the fitting of contact lenses may become more challenging. Scleral lenses offer a unique way of addressing many issues raised in this case report including corneal neovascularization and ectasia. This lens modality may be considered for any other case involving irregular corneal curvature following surgery resulting in reduced visual acuity.


## 1. Introduction

Post-LASIK ectasia is defined as refractive or optical regression resulting from a bulging forward of the ablated cornea slightly to steepen both the anterior and posterior corneal curvature, after an uneventful LASIK (Laser-Assisted in situ Keratomileusis) procedure [1,2]. This bulging forward occurs similarly with corneal relaxation incisions after radial keratotomy (RK) [2]. In RK, however, the peripheral cornea is weakened, leading to steepening of the peripheral and flattening of the central cornea, whereas in myopic LASIK, the thinner and weaker central cornea results in central steepening. Currently, this condition is challenging to manage for refractive surgeons, and several therapeutic options have been proposed in recent studies [1]. These include RGP (rigid gas-permeable) contact lenses, corneal collagen crosslinking, topography-guided PRK (photorefractive keratectomy) with simultaneous crosslinking, corneal transplantation, and ICRS (intrastromal corneal ring segments). Evidence is meager regarding the best indication for each treatment option [1]. For reasons that are not apparent, the patient reported in this case received two different treatments in each eye. The case is relevant and particularly instructive, because despite different treatments in each eye and several modifications to the initial lens fitting, scleral lens therapy resulted in good acuity and comfort bilaterally. This report explores the challenges of fitting a scleral lens after different treatments in each eye and the troubleshooting involved in reaching a successful outcome in both. Of note, patient consent was received for both use of images and publication of the case.

## 2. Case report

In the summer of 2013, patient JV, a 38 year-old Hispanic male, presented to the Global Vision Rehabilitation Center. He was referred by a cornea specialist for a contact lens evaluation for the treatment of fluctuating and unstable vision in both eyes and difficulty driving at night owing to halos and starbursts around lights. A review of his ocular history revealed LASIK in both eyes in 2001, ICRS surgery 2 months prior in the left eye and a cross-linking procedure in the right eye 4 weeks prior to this initial presentation. He was also wearing an amniotic membrane corneal bandage lens, PROKERA® (Bio-Tissue, Miami, USA), 3 weeks prior to presentation

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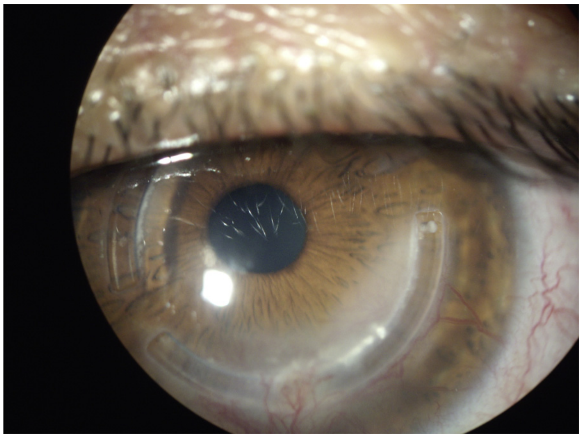

**Fig. 1.** ICRS with crystallized deposits around the ring segments. Superficial stromal vascularization extending to and arborizing along the inferior ring segments at 4:00 and 6:00 can be seen. Mild underlying haze around the inferior ring segment can also be observed.

for 4–5 days over his right eye following the cross-linking. He had no history of glaucoma or trauma and was not using any eye drops. He had no family history of ocular disease nor had he been diagnosed with any medical problems, was not taking any medications and had no allergies to drugs.

Entering acuities measured 20/40 in the right eye and 20/30 in the left eye with spectacle correction. His refraction measured OD: +2.25 − 4.50 × 080 and OS: +2.75 −5.00 × 105. With this correction, his acuities were 20/30 and 20/25, respectively; yet he reported significant distortion of the letters. His pupils were equal, round and reactive to direct and consensual illumination, and no afferent pupillary defect in either eye was observed. Confrontational visual fields were full to finger counting in both eyes and extraocular motility was full in both eyes. Slit lamp examination revealed Intacs segments in place 2 mm above and below the pupil in the left eye, with crystallized deposits around the ring segments. He had superficial stromal vascularization extending to and arborizing along the inferior ring segment at 4:00 and 6:00, with mild underlying haze (Fig. 1). The patient had clean lids and lashes, white and quiet conjunctivas, flat irides and clear lenses OD, OS. No proptosis or lid abnormalities were observed in either eye. Intraocular pressures by Goldmann applanation tonometry measured 13 mm Hg OU at 11:00 AM using one drop 0.5% proparacaine hydrochloride ophthalmic solution. Upon dilated fundus examination (using one drop 1% tropicamide and 2.5% phenylephrine OU), the cup-to-disc ratios were 0.2 OD, OS. The neuroretinal rims were healthy and pink in both eyes. The maculae were clear and flat in both eyes, and retinal vasculature was of normal course and caliber. No breaks were observed in the retinal periphery. A flat nevus was seen just superior to the arcade in the right eye, of approximately 2/3 of a disc diameter.

After the glasses were prescribed, contact lenses were strongly recommended as the primary treatment for the ectactic corneas in both eyes with vascularized Intacs in the left eye. In this condition, the ocular surface must be protected to minimize the risk of erosion; contact lenses help to maintain constant lubrication of the corneal surface, which allows for its restoration. A soft bandage does not provide a good outcome for visual correction on a highly irregular cornea. Small diameter rigid gas-permeable (RGP) lenses can provide a better alternative to improve visual acuity but do not protect the ocular surface. In fact, these lenses can increase mechanical stress on an already altered cornea in this case. One of the ways to resolve this issue could be to consider a piggy-back system, which implies fitting a high oxygen permeability soft lens carrier on top of which a high-permeability RGP lens is fitted. In that way, the soft carrier aims to protect the cornea while the RGP restores visual acuity. Another solution includes the implementation of hybrid lenses. These consist of a gas-permeable rigid center surrounded by a silicone hydrogel soft skirt. In fitting this lens, the skirt is designed to lift the rigid center off the corneal surface so that it never has to interact with it. However, cases of warpage with these lenses have been reported [3]. In addition, few, if any, hybrid lenses offer enough oxygen permeability to maintain ocular health in the presence of a compromised cornea [3].

Large-diameter RGP lenses can also be considered. These designs have become more and more popular and are available in several options: a corneo-scleral lens (12.5–15 mm), supported partly by the cornea and partly by the sclera; a mini-scleral lens (15–18 mm) vaulting the cornea, supported by the fluid layer and the conjunctiva; or a larger scleral lens (18–25 mm) with the same fitting philosophy as the mini-scleral lens but with different parameters [4]. They are fitted in a way to vault the cornea. They maintain a constant reservoir of fluid between the posterior surface of the lens and the anterior surface of the cornea to ensure hydration [5]. This fluid layer also compensates for the surface irregularities, leading to improved visual acuity. In fact, correction of irregular astigmatism was the primary indication for scleral lenses in early studies, but more recent studies have confirmed their utility in the management of various ocular surface diseases including keratoconjunctivits sicca, neurotrophic keratopathy, cicatrizing conjunctivitis, limbal stem cell deficiency, and exposure keratopathy [4]. The unique way scleral lenses are fitted enable them to protect the ocular surface from the friction generated by eyelid movement and provide corneal hydration [5]. This modality can provide the comfort of a soft lens with the optical quality of a gas-permeable lens [4]. Large-diameter RGP lens designs currently available are therefore considered the best option to provide health benefits and increased comfort compared to smaller corneal RGP and, in this case, soft lenses.

In the current case of post-LASIK ectasia followed by cross-linking in one eye and ICRS in the other, the choice of which type of large-diameter RGP lens to use should ensure that no touch on the cornea occurs. Corneo-scleral lenses are contraindicated, because a small portion of the cornea supports most of the weight of the lens. This may result in a stress to the tissue that could cause a corneal epithelial defect and/or generate scarring. Mini-scleral lenses represent an improved option, where cornea–lens touch is absent but the fluid layer limited. They are also smaller than the large scleral lenses and are therefore easier to handle and less intimidating for patients to insert into their eyes [4].

The Jupiter scleral lens (Essilor Contact Lens, Dallas, TX) was chosen and the fitting was facilitated by the use of a diagnostic set of 14 lenses. The initial diagnostic lens was selected according to the manufacturer's fitting guidelines. The base curve radius of the diagnostic lenses ranged from 6.25 to 8.44 mm, the lenses were 16.60 mm in diameter, and made of Boston XO material. The clearance or fluid reservoir under the lens was evaluated with the help of the Visante™ Anterior Segment OCT (Ocular Coherence Tomography) (Zeiss, Jena, Germany). When adequate apical clearance was confirmed (150–200 μm) in both eyes (Fig. 2), the lenses were ordered with the following parameters:

OD: diameter: 16.60 mm, base curve 41.00 D (8.23 mm) reverse curve, power −0.75
OS: diameter: 16.60 mm, base curve 39.00 D (8.65 mm) reverse curve, power +1.50.

Following appropriate training, the patient was proficient with both insertion and removal of the lenses. He was instructed in lens care and handling with RGP cleaner and conditioning