

# Explantation and Rotation of Intracorneal Ring Segments with the Support of Femtosecond Laser: An Asymmetrical Version

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## ABSTRACT

**Purpose:** To report a 25-year-old man who presented with advance keratoconus in the right eye with uncorrected visual acuity (UCVA) of 0.2 and best spectacle-corrected visual acuity (BSCVA) of 0.33 with +0.50 -9.25 × 45°.

**Materials and methods:** Clinical examination and corneal topography revealed grade III keratoconus in the right eye. Intracorneal ring segments (INTACS SK; Addition Technology, Des Plaines, IL) were implanted without surgical complications at 400 μm, with the 450 μm segments implanted superiorly and inferiorly using the femtosecond laser (Intralase®, Advanced Medical Optics, Inc, Abbott Park, IL).

**Results:** For 3 months postoperatively, BSCVA remained at 0.5 with plano -4.50 × 25°. The patient was complaining of foreign body sensation in the upper part of the eye and glare asking the surgeon to remove the two segments. The superior segment was removed and the lower segment was rotated 30° counter clockwise. Three months later, UCVA was 0.67 and remained stable for 24 months of follow-up.

**Conclusion:** This report shows that implanting the thicker segment inferiorly provides better visual results.

**Keywords:** Keratoconus, Intracorneal rings, Intralase.

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## INTRODUCTION

Keratoconus is noninflammatory progressive corneal thinning of unknown etiology in which the cornea assumes a conical shape, resulting in mild to marked impairment of visual acuity due to irregular astigmatism and progressive myopia.<sup>1-3</sup> Intrastromal corneal ring segments have been investigated for the correction of mild to moderate myopia and have also been considered as a treatment modality for correcting keratoconus, which could provide a surgical alternative to delay, if not to avoid keratoplasty, in keratoconus patients.<sup>4</sup> Intracorneal ring segments (ICRS) act by an 'arc shortening effect' on the corneal lamellae and flattening of the central cornea.<sup>5</sup> Intacs SK is a new design of intrastromal corneal ring segments with a smaller 6 mm optical zone to correct higher grades of keratectasia and a proprietary elliptical cross-section to minimize glare

usually associated with smaller optical zones. The acronym 'SK' denotes severe keratoconus or steep keratometry.

The advantages of ICRS are safety, reversibility and the fact that the surgical process does not affect the visual axis of the cornea.<sup>6</sup> This report illustrates the dramatic change in the visual outcome after explanting one of the segment in an eye with advance keratoconus.

## CASE REPORT

A 25-year-old man presented with advanced keratoconus in his right eye. He reported that for the last year he tried to wear hard contact lens but recently he became intolerant for the contact lens. Examination revealed uncorrected visual acuity (UCVA) of 0.2 and best spectacle-corrected visual acuity (BSCVA) of 0.33 with +0.50 -9.25 × 42°, with normal anterior segment and normal fundus. Corneal topography was performed using the EyeSys Vista (EyeSys Vision, Inc, Houston, Texas, USA), revealing grade III keratoconus in the right eye with  $K_{max}$  56.75 diopters (D),  $K_{min}$  42.41 D (Fig. 1).

A symmetrical ICRS segments (INTACS SK; Addition Technology, Des Plaines, IL) were implanted according to our standard surgical procedure under topical anesthesia. The pachymetric readings were confirmed by ultrasonic pachymetry prior to the surgery. The femtosecond laser

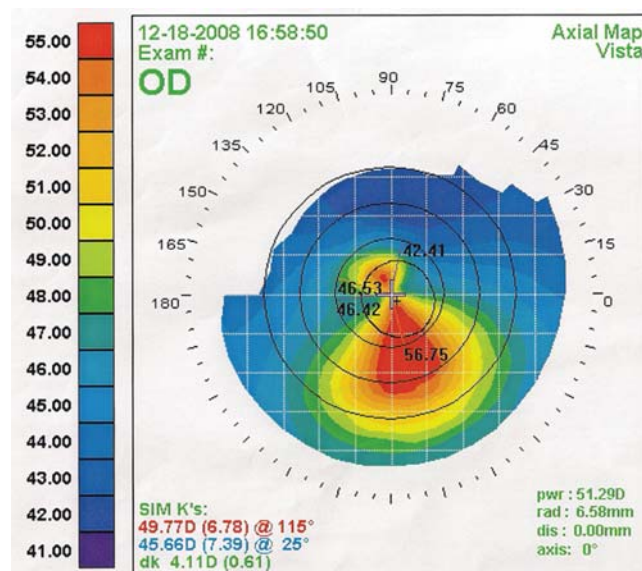


Fig. 1: Preimplantation topography of the right eye with keratoconus

(Intralase<sup>®</sup>, Advanced Medical Optics, Inc, Abbott Park, IL) was used to create intrastromal channels for ICRS at a depth of 400  $\mu\text{m}$ , with inner and outer diameters of 6.0 and 7 mm, respectively. A disposable suction ring and an applanation cone were used to stabilize and flatten the cornea to maintain a precise distance from the laser head to the focal point. The femtosecond laser settings were as follows: Entry cut thickness, 1  $\mu\text{m}$ ; ring energy, 1.50  $\mu\text{J}$ ; entry cut energy, 1.50  $\mu\text{J}$ ; and incision axis at 180°. After removing the suction device, the two 450  $\mu\text{m}$  (thick) segments of the INTACS were inserted into each of the semicircular channels superiorly and inferiorly.

Examination on the first month of follow-up revealed UCVA of 0.16 and BSCVA of 0.50 with plano  $-4.50 \times 25^\circ$ , with no improvement seen at 6 months follow-up (Fig. 2). The patient complained of foreign body sensation, in the upper part of the eye and glare asking the surgeon to remove the two segments. The surgeon advised the patient to remove the segments in two steps assuming reduction of foreign body sensation in the upper part of the eye but preserving some effect of the lower segment on the cornea. In the second surgery the upper segment was removed and the lower segment was rotated 30° counter clockwise. Examination 1 month of follow-up revealed UCVA and BSCVA of 0.40 with plano with improvement seen at 6 months follow-up revealed UCVA of 0.67 and BSCVA of 1.00 with plano  $-0.50/45^\circ$  with no change 24 months of follow-up (Fig. 3).

## DISCUSSION

The goal of ICRS implantation is not to treat or eliminate the existing corneal pathology but to decrease the corneal irregularity and increase the visual acuity to acceptable limits

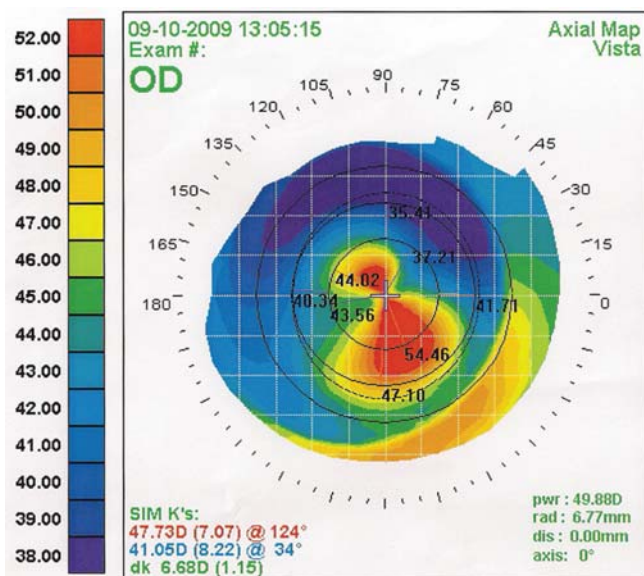


Fig. 2: Postimplantation topography of the right eye

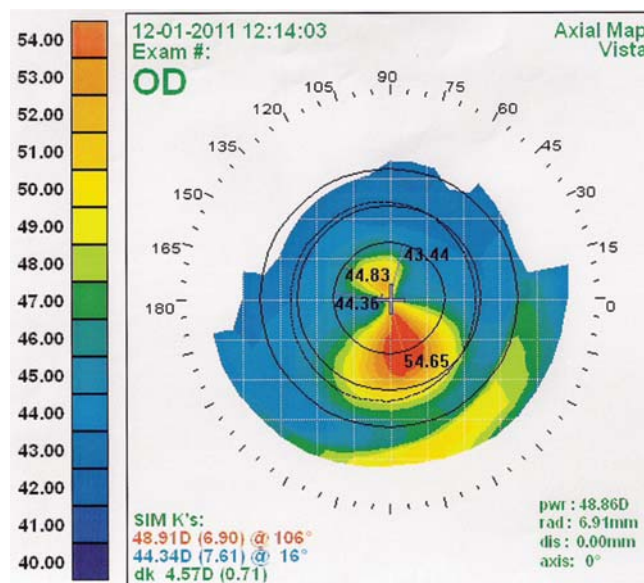


Fig. 3: Postremoval of the superior segment and rotating the inferior segment

as a way to at least delay, if not eliminate, the need for corneal grafting.

Corneal response to ICRS implantation in keratoconus is unpredictable due to the different response of keratoconic eyes.<sup>4,7</sup> ICRS (INTACS) can reduce the corneal steepening and astigmatism associated with keratoconus; the effect of INTACS on the soft corneal keratoconic tissue is much greater than that on more or less normal corneas with myopia.<sup>4,7</sup> Asymmetrical implantation has been suggested by many authors<sup>7-9</sup> in which the thicker segment is placed 'inferiorly' regarding the steepest semi-meridian of the keratoconus cone to achieve the maximum flattening and the relatively thinner ring segment placed superiorly to counterbalance the thicker segment and flatten the remaining central corneal surface at the less steep semi-meridian.<sup>4,8,9</sup>

We agree with many surgeons<sup>4,7-9</sup> regarding the option of position the thicker segment in asymmetrical INTACS implantation for keratoconus correction.

However, in our case this strategy could not be implemented because we knew the patient have a higher chance of foreign body sensation even with a thinner segment superiorly.

Although, this theory was implemented partially in this case report it illustrates, as demonstrated by the flattening achieved in the central cornea shown by corneal topography, the dramatic change in the visual outcome after removal of the superior segment and rotating the thicker segment inferiorly.

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