LETTERS TO THE EDITOR

Unusual Secondary Displacement of Intacs Segments—Superimposition of Distal Ends

We report a case of unusual secondary displacement of intrastromal corneal ring segments (Intacs; Addition Technology, Des Plaines, Illinois) away from the incision to the extent that the inferior ends overlapped in the tunnel.

A 57-year-old man presented with unilateral keratoconus in the left eye with recent contact lens intolerance. Although biomicroscopic examination of the left eye showed a Fleischer ring with no corneal opacity, the right eye was normal. Corneal topography demonstrated moderate keratoconus in the left eye and forme fruste keratoconus in the right eye. Uncorrected distance visual acuity (UDVA) in the left eye was 0.1 (Snellen decimal notation) and corrected distance visual acuity (CDVA) was 0.2 with refraction of 11.00 × 110°. UDVA in the right eye was 0.1 and CDVA was 0.8 with refraction of −1.50 −2.75 × 80°.

A two-segment, symmetric, mechanical Intacs implantation using 0.45-mm segments was performed on the left eye. Radial incision was placed on the 30° axis with a depth of 380 µm (peripheral corneal thickness, 520 µm). Postoperative examination on day 6 was normal with the two segments in perfect position and an improvement in keratometry from preoperative values of 50.00 × 29°/45.30 × 119° (Kmax/ Kmin) to 44.70 × 42°/40.60 × 132°.

At 1-month follow-up, both segments were noted to have rotated away from the incision and the distal ends of the segments had become superimposed (Figs A and C). However, keratometry improved to 43.70 × 9°/38.60 × 99° and refraction to −5.50 −2.50 × 92° with CDVA of 0.3. Because the patient was satisfied with the visual improvement, we decided to follow him without any surgical adjustment. At 3, 7, and 12 months, the anatomical aspect remained stable with no additional rotation of the segments; CDVA improved to 0.7 at 12 months with refraction of −7.00 −1.25 × 100° (keratometry 42.00 × 23°/39.40 × 113°) (Fig B).

The right eye demonstrated no progression of keratoconus with stable refraction and keratometry throughout 12-month follow-up.

The natural tendency of segment migration is towards the incision.1 A superficial implantation2 or distance <1 mm between the incision and proximal

Figure. A) Slit-lamp microscopy illustrating superimposed distal ends of Intacs segments. B) Corneal topography at 12 months demonstrating good anatomical outcome. C) High resolution anterior segment optical coherence tomography demonstrating the cross-sectional view of superimposed Intacs segments.
tip of the Intacs segments\textsuperscript{3,4} may accentuate incision migration. Although there are no documented associations of migration away from the incision, rubbing of the eyes could cause the segments to overlap. As such, rubbing may cause migration either towards or away from the incision. Although no history of eye rubbing or trauma was reported, we believe that inadvertent forceful rubbing of the eye while sleeping could have caused this phenomenon. Although not present in this case, overlap is more likely to occur if the segments are in non-contiguous channels.

This case demonstrates the importance of implanting Intacs segments at the recommended depth. Although there was a risk of corneal erosion due to superimposition of the inferior edges of the Intacs segments,\textsuperscript{3} we did not notice any corneal erosion possibly due to adequate depth.

Postoperative medications should be chosen carefully to control itching and use of a protective eye shield during the night for a longer duration should be considered to address inadvertent eye rubbing while sleeping.

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4. Pokroy R, Levinger S, Hirsh A. Single Intacs segment for post-operative excimer laser ultraviolet-C radiation and/or trauma was reported, we believe that inadvertent forceful rubbing of the eye while sleeping could have caused this phenomenon. Although not present in this case, overlap is more likely to occur if the segments are in non-contiguous channels.

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**Notes:**

- Photorefractive keratectomy was performed in the left eye with the VISX 20/20 B excimer laser (VISX Inc, Irvine, California). The planned ablation depth was 16 µm with an optical zone of 6 mm. Early postoperative UDVA was 20/20 in the left eye.
- Four years after PRK, the patient complained of decreased vision in the right eye. Keratometry readings were 48.86×130°/45.44×50° in the right eye and 43.00×70°/42.39×0° in the left eye. The topographic features were consistent with keratoconus in the right eye (Fig B).
- Ten years after PRK, UDVA was 20/100 in the right eye and 20/20 in the left eye. Corrected distance visual acuity was 20/50 in the right eye with refraction of −0.75 −1.00 × 90°. Slit-lamp examination revealed Vogt striae in the right eye but was unremarkable in the left eye. The curvature maps documented keratoconus in the right eye and a slight inferior steepening in the left eye (Figs C and D). The thinnest corneal thickness was 499 µm in the right eye and 516 µm in the left eye.
- Keratoconus and iatrogenic corneal ectasia have similar clinical, topographic, and histopathologic features.\textsuperscript{1,2} The development of ectasia after PRK may be explained by the weakening of the cornea and/or by the progression of a pre-existing pathologic condition. Forme fruste keratoconus and keratoconus in the fellow eye are among the reported risk factors for keratectasia.\textsuperscript{3} However, PRK in keratoconus suspect eyes after careful evaluation and selection (age ≥25 years and refractive as well as topographic stability) to exclude patients at risk for progressive disease, may have good and stable refractive outcomes.\textsuperscript{4}
- Photorefractive keratectomy in the left eye of our young patient, with preoperative forme fruste keratoconus, would have been an additional risk factor for corneal ectasia, but 10 years after PRK, refractive and topographic stability were noted. In contrast, the fellow eye developed keratoconus. Based on these findings, although keratoconus may be unilateral,\textsuperscript{1} one may hypothesize that PRK wound healing prevented the progression of keratoconus in the operated left eye.
- Cennamo et al\textsuperscript{5} reported that PRK provided a satisfactory “control” of early keratoconus. In contrast, topographic parameters became worse in the unoperated control eyes.\textsuperscript{5} This potential beneficial effect of PRK may have different mechanisms. The ablation of the central anterior stroma and Bowman lamina where histopathologic alterations are prevalently seen in eyes with keratoconus\textsuperscript{1} may halt the disease. But, is the removal of 16 µm (as in the reported case) enough to heal the keratoconic process? In addition, intraoperative excimer laser ultraviolet-C radiation and/or
environmental ultraviolet exposure on a cornea with no Bowman layer may have a similar stiffening effect as corneal collagen cross-linking with riboflavin and ultraviolet A light.

The reports on possible interactions of PRK with corneal biomechanical stability and keratoconus progression are conflicting. In our practice, we generally do not recommend laser refractive surgery in eyes with topographic forme fruste keratoconus.

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