Optical Coherence Tomography Provides Insight Into the Effect of Intacs in Keratoconus

Keratoconus is a bilateral, asymmetric, chronic, initially progressive ectasia of the cornea characterized by steepening, distortion, and thinning of the apical cornea as well as corneal scarring.1 Intrastromal corneal ring segments (Intacs; Addition Technology Inc, Sunnyvale, California) is 1 treatment option available for patients with keratoconus, especially those with contact lens intolerance. Intacs placement in patients with mild to moderate keratoconus generally improves best spectacle-corrected visual acuity (BSCVA) and uncorrected visual acuity and reduces astigmatism.2 Intacs have generally been found to be safe and effective. However, the exact effect Intacs have on the keratoconic cornea is still debatable. Here we imaged the corneal changes induced by Intacs using comparative image analysis of optical coherence tomography (OCT).

Report of a Case. A 54-year-old man diagnosed with keratoconus in his left eye underwent Intacs implantation after becoming intolerant to contact lenses. Preoperative BSCVA was 20/40 with a +1.50−4.25×142° correction. Anterior segment OCT (Visante OCT; Carl Zeiss Meditec, Dublin, California) was performed 1 week preoperatively using the quad line scan corneal high-resolution mode (Figure 1A). A femtosecond laser (Intralase Corp, Irvine, California) was used to create the channels at 400-µm depth. The Intacs incision was placed on the steep axis (45°). A large segment (0.45 mm) was implanted inferiorly and a smaller one (0.25 mm) superiorly. Two weeks after surgery, BSCVA was 20/25 and the segments were well positioned. Visante OCT was performed again with the exact same parameters as preoperatively (Figure 1B). The image shows the Intacs to be partially bulging into the anterior chamber and partially compressing the stroma above them.

The preoperative and postoperative images were superimposed (Figure 2A) and subtracted from one another (Figure 2B). The superimposed image shows no change in the cone’s apex position after Intacs insertion. The main effect of the Intacs seems to be an elevation of the corneal stroma above the inferior segment, creating a flattening of the corneal surface in that area. Six months postoperatively, BSCVA was 20/30 with a +0.50−1.50×135° correction.

Comment. Because topographically Intacs seem to flatten and center the keratoconic cone, one would assume that they exert their effect by actually flattening and stretching the corneal apex. Based on this assumption, inserting the Intacs segments into smaller and tighter corneal channels should enhance their effect. However, Ertan et al3 found no effect of the channel size on refractive outcome. If one accepts the apex flattening assumption, one would suggest inserting 2 large (0.45 mm) ring segments to exert the largest flattening effect. Although earlier studies had advocated the use of 2 segments during the surgery,4,5 newer studies seem to find better results with just 1 inferior segment. Sharma and Boxer Wachler1 found significantly more improvement in uncorrected visual acuity, BSCVA, steep K values, and inferior-superior ratio and a greater cylinder decrease in the single-segment group than in the double-segment group.

Because stretching the cone can also be performed from above, some suggested inserting the thicker segment superiorly to try to center an inferiorly located cone. However, Chan and Wachler6 found that inserting the thicker

![Figure 1](https://example.com/figure1.png)

**Figure 1.** High-resolution anterior segment optical coherence tomography of pre-Intacs (A) and post-Intacs (B) keratoconic cornea imaged on the 135° axis. No change was seen in the apical thickness of the cone. The thicker Intacs segment seems to compress the overlying stroma more.

![Figure 2](https://example.com/figure2.png)

**Figure 2.** High-resolution anterior segment optical coherence tomography images. A, The pre-Intacs (blue) and post-Intacs (red) optical coherence tomography images from Figure 1 are superimposed, showing a local elevation and flattening of the corneal surface above the thicker inferior Intacs segment (arrow). No change was noticed in the location or steepness of the cone’s apex. B, The digital subtraction of the 2 images again shows the Intacs-induced elevation and surface flattening (arrow).
As observed using OCT, we suggest here that the effect of Intacs in keratoconus is not on the cone’s apex but rather a more limited local flattening effect on the cornea surface above the segment. Because Intacs do not stretch the cone itself, it would explain why 1 inferior segment is better than 2 segments and why tighter channels should not make a difference. The local effect also explains why inserting a thicker superior segment is not as good as inserting a thicker inferior one near the steepest area of the cornea.

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Pulmonary Metastasis Masquerading as Anterior Uveitis

Uveal metastasis is the most common intraocular malignancy, but iris involvement accounts for only 5% to 10% of cases. Most iris metastases are carcinomas, with breast, lung, and gastrointestinal tract carcinomas representing the majority of primary tumors. Renal cell carcinoma is also reported to result in metastasis to the iris. There is no history of a previously diagnosed primary tumor in 32% of cases. We report a case in which an iris lesion led to the detection of lung cancer.

Report of a Case. A 65-year-old white woman noted pain in her left eye, was diagnosed with anterior uveitis, and was treated with topical steroid drops. Two weeks later an iris mass was noted. The mass enlarged during a 2-week period.

Figure 1. Iris mass in the left eye. A, In the left eye, the nasal iris mass deep to the iris stroma with overlying metastatic seeding appearing as pseudokeratic precipitates (arrows). B, Gonioscopy showing the mass and aggregates of tumor cells shed into the angle (arrows). C, Ultrasound biomicroscopy of the iris mass showing the multicystic nature of the mass and the lack of scleral invasion. Arrows indicate cystic spaces within the mass. D, Anterior view of the entire iris mass.