

Intralase FS Laser for ICR Implantation

The femtosecond laser technology can assist with the placement of intracorneal ring segments in eyes with keratoconus and post-LASIK ectasia.

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Treating moderate-to-advanced keratoconus and post-LASIK ectasia with intracorneal ring (ICR) segments may delay the need for a penetrating keratoplasty. The femtosecond laser may provide advantages over manual corneal dissection for intracorneal ring placement.

The Intralase FS laser (Intralase Corp., Irvine, CA) is widely used to create corneal flaps for LASIK surgery. Recent studies¹⁻⁵ on the use of the Intralase system have shown the laser may be safer and more predictable than mechanical microkeratomers. A more recent application of the laser is in the creation of the corneal channels for ICR implantation in patients with advanced keratoconus or post-LASIK ectasia.

In 2004, Yaron Rabinowitz, MD, reported that placing Intacs (Addition Technology Inc., Des Plaines, IL) with a femtosecond laser is less traumatic and more accurate than using a mechanical keratome.⁶ We have also observed that the Intralase has advantages compared with

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conventional manual dissection for implanting Intacs as well as Ferrara rings (Mediphacos Ltd., Belo Horizonte, Brazil).⁷ Advantages include a minimally invasive technique, more uniform dissection, more consistent results, less patient discomfort, faster visual recovery, and more accurate placement. Due to decreased tissue handling, the risk of infection may also be reduced. In our opinion, a key benefit is the ability to customize the size of the corneal channel to match the dimension of the acrylic ICR. Accurate sizing may lead to a more stable biomechanical result.

STUDY Population

We used the Intralase FS laser to implant both Ferrara rings and Intacs segments. To our knowledge, this is the first report on the use of the Intralase system for Ferrara Ring implantation.

The Ferrara Ring group included a total of 17 cases (11 patients; nine unilateral, four bilateral) with a minimal follow-up of 6 months. This population included 15 eyes with keratoconus and two with post-LASIK ectasia. Subjects' mean age was 29.25 years, and their average preoperative pachymetry was 497.12 μ m (range, 413 to 566 μ m).

The Intacs group included 12 cases (eight patients; eight unilateral, two bilateral) with a follow-up of at least 6 months. This group included 11 eyes with keratoconus and one post-LASIK. The mean age was 35.83 years, and

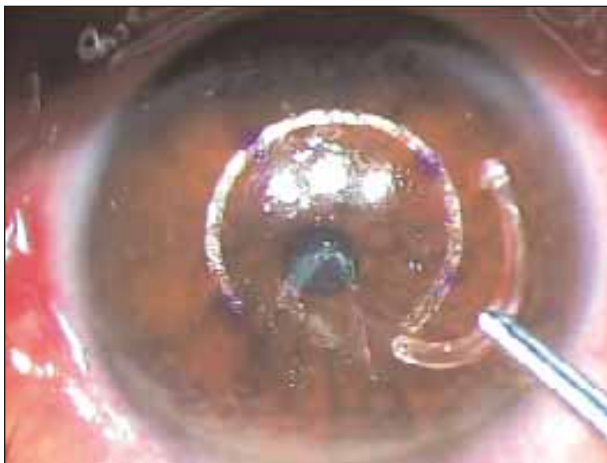


Figure 1. The surgeon used the Intralase FS laser to carve channels for implanting the Ferrara Ring.

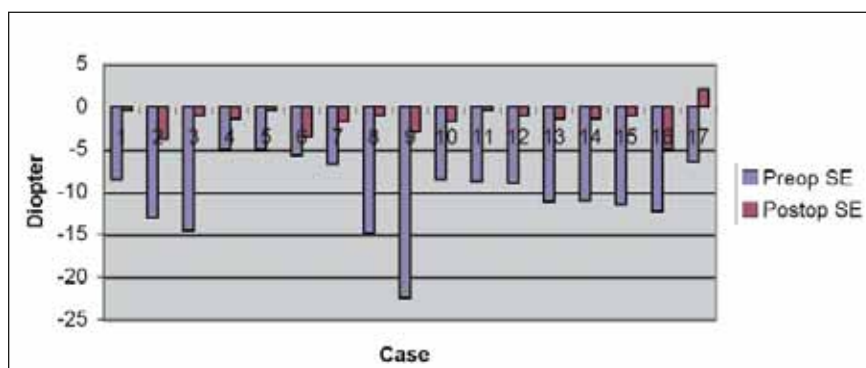


Figure 2. The surgeons analyzed the pre- versus postoperative spherical equivalent reduction in the Ferrara Ring group.

the average preoperative pachymetry was 520 μ m (range, 462 to 557 μ m).

Intralase parameters for Ferrara ring implantation included a corneal depth of 400 μ m, contact-glass depth of 60 μ m, inner ring diameter of 4.8mm, outer ring diameter of 5.3mm, entry cut length of 1.2mm, and entry cut thickness of 1 μ m. The mid-axis of ring placement was set 90° from the steepest topography axis.

The Intralase parameters used for Intacs implantation included a corneal depth of 400 μ m, contact-glass depth of 60 μ m, inner ring diameter of 6.6mm, outer ring diameter of 7.3mm, entry cut length of 1.2mm, and entry cut thickness of 1 μ m, with the same axis placement as for the Ferrara Rings.

Technique

We used proparacaine drops for topical anesthesia. We centered the treatments on the visual axis (not the pupil). We positioned the patients on the Intralase bed and placed a Lieberman-type lid speculum (Katena Products, Inc., Denville, NJ). Using a disposable Intralase cone, we lowered the contact glass onto the cornea until the peripheral meniscus was eliminated and adequate pressure was achieved. Final centration was achieved manually and confirmed using the laser's display. We engaged the laser and created the channels. Channel creation required approximately 5 to 6 seconds.

We performed our first 12 cases using the Swanson nomogram for Intacs and the Paulo Ferrara nomogram for the Ferrara Rings, differing each only in the inner and outer diameter of the corneal channel dissection. Once the Intralase laser carved the corneal channel, we located the en-

trance of the channel using a spatula. Due to concerns about creating a false entry, we abandoned this technique for subsequent cases.

For the remaining cases, we used the ring segment to dissect the channel, thereby avoiding the need for performing the dissection and placement of the ring in two steps. We performed ICR implantations using the specific forceps indicated with each ring. We used a Sinsky hook (Katena Products, Inc.) to complete the

insertion of the Intacs segments and we employed a cannula to complete the insertion of the Ferrara Rings (Figure 1). We prescribed steroids, antibiotics, and lubricant drops q.i.d. after surgery and tapered them gradually during the following 4 weeks.

RESULTS

Refractive Outcomes

The mean preoperative spherical equivalent in the Ferrara Ring group was -10.53D (range, -5.00 to -22.50D; standard deviation = 5.51D). At 6 months, the mean postoperative spherical equivalent was -1.57D (range, 2.00 to -3.75D; standard deviation = 1.57D). All 17 cases achieved an improvement in spherical equivalent postoperatively (Figure 2).

The mean preoperative spherical equivalent in the Intacs group was -4.66D (range, -1.00 to -8.00D; standard deviation = 1.87D). At 6 months, the mean postoperative spherical equivalent was -2.12D (range, -0.25 to -4.50D; standard deviation = 1.29D). All 12 cases achieved an improvement in spherical equivalent postoperatively (Figure 3).

Topography Results

We used Orbscan (Bausch & Lomb, Rochester, NY) to analyze posterior-elevation changes. We compared the

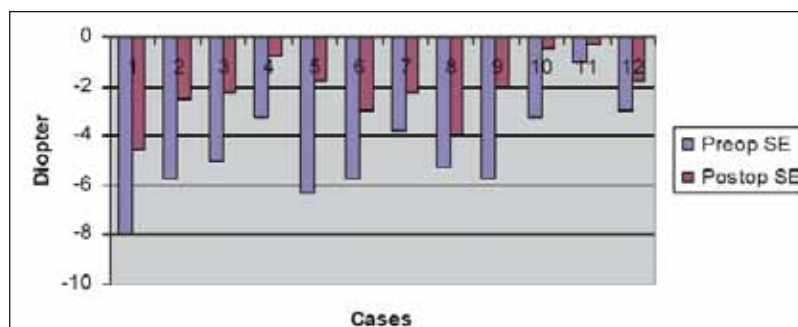


Figure 3. The surgeons analyzed the pre- versus postoperative spherical equivalent reduction in the Intacs Intralase group.

steepest pre- and postoperative elevations using the dual map display (Figure 4).

In the Intacs group, the mean preoperative posterior elevation was 68 μ m (range, 28 to 87 μ m; standard deviation = 24.1 μ m). In this group, the mean postoperative posterior elevation was 44 μ m (range, 0 to 62 μ m; standard deviation 23.8 μ m) for a mean improvement of 24 μ m.

In the Ferrara Ring group, the mean preoperative posterior elevation was 92 μ m (range, 47 to 125 μ m; standard deviation = 29.4 μ m). Mean postoperative posterior elevation was 60 μ m (range, 15 to 91 μ m; standard deviation = 30.52 μ m) for a mean improvement of 32 μ m.

CONCLUSION

In this series, the Intralase successfully created channels to allow the placement of both Intacs and Ferrara ring segments in the treatment of keratoconus. This series does not provide a direct comparison of Intralase versus mechanical dissection for safety and effectiveness. However, in our opinion, the Intralase may provide advantages for the placement of corneal ring segments over mechanical dissection by decreasing the chances of perforation in these deep dissections. Additionally, laser channel carving provides excellent symmetry of ring placement, especially when implanting Ferrara Rings compared with the manual procedure. Whereas manual dissection yields uniformly sized channels, one may customize the channels to the segments with the Intralase laser.

The Intralase procedure for ICR implantation is a minimally invasive technique. Our first Ferrara Ring patient was a 10-year-old girl. We used topical anesthesia, and she tolerated the procedure well. Preoperatively, her UCVA was 20/100, and her BCVA was -4.50 -8.00 X 15 = 20/50.

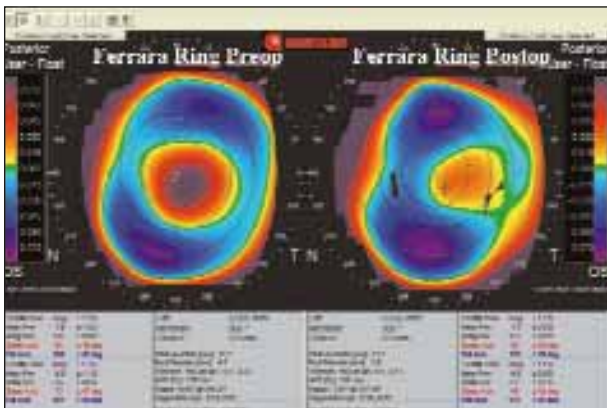


Figure 4. The surgeons analyzed Orbiscan dual control maps from a Ferrara Ring and Intralase case. At the 306° meridian and 0.8-mm radius, the preoperative posterior elevation of 95 μ m decreased to 26 μ m for a posterior-float modification of 69 μ m.

At 1 week postoperatively, her UCVA was 20/40, and her BCVA was 1.00 -2.50 X 15 = 20/30. In our experience, using the Intralase for ICR implantation is better tolerated than mechanical dissection with less postoperative discomfort and faster recovery of visual acuity.

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Changes in spherical equivalent were significantly higher for the Ferrara Rings than Intacs, possibly due to the diameter of Ferrara Ring's being smaller and implanted closer to the visual axis, thus increasing the corneal flattening effect. The mean total reduction in spherical equivalent effect for the Ferrara Ring went from -10.53D preoperatively to -1.81D postoperatively, with a mean reduction of 8.72D. The mean total reduction in spherical equivalent effect for Intacs went from -5.73D preoperatively to 1.31D postoperatively, with a mean reduction of 4.42D. ■

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1. Durrie DS, Kezirian GM. Femtosecond laser versus mechanical keratome flaps in wavefront-guided laser in situ keratomileusis: prospective contralateral eye study. *J Cataract Refract Surg.* 2005;31:120-126.
2. Tran DB, Sarayba MA, Bor Z, et al. Randomized prospective clinical study comparing induced aberrations with Intralase and Hansatome flap creation in fellow eyes: potential impact on wavefront-guided laser in situ keratomileusis. *J Cataract Refract Surg.* 2005;31:97-105.
3. Durrie DS, Stahl J. Randomized comparison of custom laser in situ keratomileusis with the Alcon Customcornea and the Bausch & Lomb Zyoptix systems: one-month results. *J Refract Surg.* 2004;20(suppl):614-618.
4. Kezirian GM, Stonecipher KG. Comparison of the Intralase femtosecond laser and mechanical keratomes for laser in situ keratomileusis. *J Cataract Refract Surg.* 2004;30:804-811.
5. Binder PS. Flap dimensions created with the Intralase FS laser. *J Cataract Refract Surg.* 2004;30:26-32.
6. Rabinowitz, Y. Penetrating keratoplasty versus intracorneal rings/segments for keratoconus. Paper presented at: The ASCRS/ASOA Symposium on Cataract, IOL and Refractive Surgery Meeting; May 1, 2004, San Diego, CA.
7. Sanchez F. Use of Intralase for Ferrara Ring and Intacs implantation in keratoconus and LASIK ectasia treatment. Paper presented at: The World Cornea Congress Meeting; April 14, 2005; Washington, DC.