Comparing refractive outcomes in keratoconus patients

Study demonstrates the importance in considering all options in managing keratoconus

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Keratoconus is a condition that affects 1 in 2000 individuals. It results in thinning and steepening of the cornea and this leads, in turn, to irregular astigmatism, increased coma (high order aberration) and decreased quality of vision. Associated systemic conditions may include atopic disease and eye rubbing.

In the management of keratoconus, it is important to consider a practical and functional classification of keratoconus, because based on this a treatment approach will be generated. It is also important to consider the goal that is being achieved in the management of these patients.

In general, I tend to classify keratoconus as mild, moderate, or severe. In terms of practical aspects, mild and moderate keratoconus have central pachymetry readings greater than or equal to (> or = to) 400 microns and keratometry readings less than or equal to (< or = to) 55 dioptres (D); however, severe cases of keratoconus have corneal thickness lower than 400 microns and steepening greater than 55 D.

Clinically, mild keratoconus often presents as form fruste keratoconus or subclinical keratoconus, it may present in young individuals or be suspected in an eye which has more advanced keratoconus in the contralateral eye; and it may also end up progressing over time.

Moderate keratoconus begins to show contact lens intolerance, may still have good best-corrected visual acuity (BCVA) but employment issues begin to be an important aspect.

Finally, severe keratoconus is characterized by apical scarring, marked thinning and poor BCVA, all in the face of continued progression.

Evolution of treatment

In the past, observation was the only treatment offered for mild and moderate keratoconus. Patients were instructed to wear glasses or contact lenses until such a time that the condition progressed to the severe form. At that time, one would consider penetrating keratoplasty as the only treatment option.

Over the course of the past few years, there has been a paradigm shift in the management of keratoconus. Mild cases may still be managed with glasses and contact lenses; however, corneal collagen crosslinking (CXL) has become an important aspect in the management of these cases.

In fact, in mild and moderate cases CXL has been proven to arrest the condition. Visual acuity can be further improved in mild cases with phakic or pseudophakic toric intraocular lens implants.

For moderate cases, an attempt is made to improve the BCVA, either by modifying the shape of the cornea with intracorneal ring segments, or by reshaping the surface of the cornea with excimer laser procedures. In addition, the management of severe cases has evolved towards using not only penetrating but also deep anterior lamellar keratoplasty techniques.

The treatment approach is based on the specific goals. One needs to prevent rubbing to continue with the mechanical insult to the cornea, stop progression, strengthen the cornea, change the shape, improve the best-corrected visual acuity and distortion, as well as improving the uncorrected visual acuity by reducing irregular astigmatism.

Based on this, we have developed a treatment algorithm over the past several years, which is summarized in Table 1. It shows the most common techniques that are used to date, including CXL.
intracorneal ring segments (ICRS), excimer laser as well as intraocular lens (IOL) implants.

These are aimed, in various ways and combinations, at stopping progression, strengthening the cornea, changing the shape of the cornea, improving visual acuity and distortion and reducing astigmatism. Based on this, Figures 1 and 2 show clinical examples of keratoconus and post-LASIK ectasia treated with Intacs alone, or in combination with CXL, respectively.

Comparative study
We recently compared the visual and refractive outcomes following Intacs (Addition Technology Inc., Sunnyvale, California, USA) implantation in keratoconus eyes, but were particularly interested in analysing the results between central and eccentric cones. The basis for using intracorneal ring segments was to strengthen the cornea, as the Intacs provide an additive effect in the periphery, to change the shape by flattening the central cornea and reducing the amount of astigmatism, to improve visual acuity and distortion, and to address the astigmatism by improving uncorrected visual acuity.

We, therefore, compared the visual and refractive outcomes in keratoconus eyes between central cones implanted with symmetric segments versus eccentric cones implanted with asymmetric segments. Our intention was to also validate the current planning nomogram provided by the manufacturer. There is a large amount of evidence, which supports the use of ICRS, Intacs, in keratoconus and pellucid marginal degeneration.

Our approach consisted of four steps:
1. To identify the cone on an elevation map (Pentacam, Oculus GmbH, Wetzlar, Germany). In this way, we determined whether the cone was central or inferiorly located (i.e., eccentric).
2. To determine the manifest refraction and allow the patient to select the axis by rotating the axis knob on the phoropter. This provides an exquisite precision to the axis of the astigmatism.
3. Use the nomogram to select the thickness of the Intacs segment.
4. Decide on one or two segments and consider symmetric versus asymmetric implantation based on the nomogram.

In this retrospective study we included 20 patients who had symmetric (15 eyes) or asymmetric (16 eyes) implants. Intacs were implanted by a single surgeon (G.R.) and the surgical technique included creating the channels with an Intralase FS (Abbott Medical Optics Inc., Santa Ana, California, USA) with the following parameters:

- Depth of the channel 400 microns
- Internal diameter 6.8 mm, external diameter 7.8 mm.

The incision axis was determined by the preoperative manifest refraction axis. We assessed uncorrected and corrected distance visual acuity, manifest refraction spherical equivalent (MRSE), refractive cylinder and average K-readings.

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In corrected distance visual acuity, asymmetric Intacs showed statistically significant better results than symmetric implantation (p = 0.0016), however, there was no statistically significant difference between the means of symmetric and asymmetric implantation for uncorrected distance vision, MRSE, average K-reading or corneal astigmatism. With the exception of corrected distance visual acuity, which was statistically significantly better in the asymmetric group, both approaches showed a marked improvement in keratoconus eyes. We also were able to validate the pre-surgical planning guide recommended by the manufacturer.
Conclusion
In conclusion, it is important to consider all the different options in managing keratoconus patients. Intacs are one of the options available. At this point we are combining, on a regular basis, Intacs with CXL, CXL with excimer laser ablations and/or Intacs, and any of these combinations with intraocular correction of astigmatism using toric IOLs.

Reference

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