Abstract: Recent developments in the treatment of keratoconus will change the standard of care for these patients in the near future. This case report discusses a patient who underwent Intrastromal corneal Intacs and collagen cross-linking.

I. Case History
- Patient demographics: 32 year old African American female
- Chief complaint: No visual complaints, but interested in a soft contact lens fitting
- Ocular History: Keratoconus OU, s/p Intacs implantation and collagen cross-linking x 3 months
- Medical history: Unremarkable
- Medications: None
- Other: She wore rigid gas permeable lenses for 20 years and over time became intolerant. Thus, she decided to undergo Intacs implantation and collagen cross linking in hopes of being able to be fit into soft contact lenses.

II. Pertinent findings
The patient was seen 2.5 months before she underwent the Intacs implantation and collagen cross linking. The manifest refractions and visual acuities at that visit were OD -3.50-6.00x015 20/30, OS -4.00-3.50x137 20/30. At 3.5 weeks post-op, the patient’s manifest refraction and best corrected visual acuities were OD +1.00-2.00x010 20/25- OS -0.75 DS 20/20-2. Her corneal topographies revealed approximately 4.00D of flattening in each eye. She was then fit with: OD Biofinity Toric 8.70/+1.00-1.75x010 20/20-2, OS Biofinity DW 8.60/-0.75 20/20-2. At subsequent follow-up visits, the patient’s refraction became unstable and she developed a significant amount of astigmatism in both eyes. Her most recent visit, which was 3 months post-op, revealed manifest refractions and visual acuities of OD +1.25-8.00x040 20/30-2, OS -1.50-6.00x150 20/20. In addition, the patient’s corneal topographic maps showed progressive corneal steepening in both eyes which has almost reached her pre-operative K-values.

III. Differential diagnosis
Not applicable to this case.

IV. Diagnosis and discussion
Keratoconus is a progressive, non-inflammatory, corneal ectasia characterized by corneal thinning and steepening. It is typically a bilateral condition with one eye being more severely affected than the other eye. Visual acuity loss and distortion results from high myopia, irregular astigmatism, and corneal scarring. Keratoconus often presents during puberty and progresses until the third or fourth decade of life. The estimated prevalence of keratoconus is approximately 1 in 2,000.

Mild keratoconic patients can be treated with spectacle lenses, but approximately 90% of keratoconic patients are treated with either soft toric lenses or rigid gas permeable lenses. Once these patients become contact lens intolerant, other treatment options must be considered.
Intrastromal ring segments or Intacs are arc-like PMMA segments that are surgically inserted within the peripheral corneal stroma in order to lift the ectatic areas of the cornea and therefore flatten the central cornea. These devices were FDA approved in 2004 under a Humanitarian Device Exemption, meaning that the FDA has designated this medical device for use in fewer than 4000 patients per year. The goal of this procedure is to remodel the cornea and thus, delay or prevent the need for a corneal transplant. Indications for Intacs include: contact lens intolerance, mild to moderate keratoconus with a clear optical zone, steep keratometry reading not exceeding 58.00D, and corneal thickness of at least 450 microns at the insertion site. Recent studies show an average of 2-3D of corneal flattening with an accompanying 2-3 lines of gain in best corrected visual acuity. Complications are rare, but include perforation of the segment into the anterior chamber, segment decentration, segment migration, corneal neovascularization, and corneal haze around the segment.

Corneal collagen cross-linking is currently undergoing FDA clinical trials. The goal of collagen cross-linking is to slow or stop the progression of keratoconus by creating new corneal collagen bonds, which strengthens the weakened corneal structure of keratoconic patients. The most widely accepted method of performing collagen cross-linking includes the following:
1) Remove the central 9mm of the corneal epithelium  
2) Apply iso-molar riboflavin 0.1% drops solution with dextran 20% to the exposed stroma every 4 to 5 minutes for 30 minutes  
3) Apply UVA light (370nm) to the exposed stroma for 30 minutes at a distance of 54mm while still applying the riboflavin solution every 4 to 5 minutes. The riboflavin acts as a photosensitizer to create reactive oxygen species that ultimately result in corneal crosslinks and it also absorbs the UV radiation, protecting the deeper ocular structures. A recently published study by Caporossi et al. found that 44/48 (92%) eyes followed for 48-60 months after undergoing collagen cross-linking showed stability or improvement in best corrected visual acuity. There was a mean reduction in keratometry readings of 2 D and a mean improvement of best corrected visual acuity of 1.9 Snellen lines. Greater than 65% of the fellow untreated eyes showed progression. The major finding in all the preliminary data is that the corneal stroma must be at least 400 microns thick throughout the entire treatment in order to protect the deeper ocular structures.

V. Treatment, management
Since the above mentioned patient received two treatments at the same time, it is unclear as to which procedure did not work. Currently, collagen cross linking is a one-time treatment, but further research must be performed to confirm this thought process. As for Intacs, the implantation is reversible and one study by Alio et al shows significant visual and refractive improvement in patients who underwent implantation of new intrastromal ring segments following explantation of unsuccessful ring segment implantation. Another option for this patient is to return to rigid gas permeable contact lenses. This will most likely be an unfavorable option for the patient because her goal after undergoing the two procedures was soft contact lens wear.

VI. Conclusion
As eye care providers, we must be up to date with all current treatment modalities and be honest with our patients about potential outcomes. Although the vast majority of patients that undergo Intacs implantation and collagen cross linking obtain desirable results, some patients develop complications and undesirable results. It is also important to present clinical findings to patients in an honest, but respectful manner. This patient was under the impression that her
vision was going to eventually get better and she was very hesitant to contact her surgeon. It was my role to inform her that not only was her vision probably not going to get better, but that it had actually gotten worse since the procedures. Lastly, we should never underestimate the usefulness of corneal topography. Topography was an invaluable tool in managing this patient because it allowed me to witness the progressive steepening of her cornea week by week and therefore explain the fluctuations in her visual acuity and refraction.

References:


