Progressive corneal steepening after Artisan toric IOL implantation for postkeratoplasty ametropia

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Setting
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Case
This study describes the case of a 67-year-old female patient suffering from keratoconus, who developed a progressive corneal steepening following a full-thickness perforating keratoplasty and subsequent implantation of an Artisan phakic IOL.

In 1994, she presented at another ophthalmologist with a best-corrected visual acuity (BCVA) of 0.3 with -9.5C -0.5x85 and 0.15 with -10.5C -3.5x35 of the right and left eye, respectively. Apart from the myopia, she was diagnosed as suffering from a keratoconus bilaterally, which was treated one year later using a full-thickness perforating keratoplasty for the left eye. Two graft rejections were treated successfully postoperatively. Four years after the transplantation, it turned out that the BCVA remained low at 1/60 despite the clear transplant, while treating the astigmatism using a hard contact lens proved impossible due to intolerance.

Upon her referral to the academic hospital of Maastricht in 1999, seven years after the keratoplasty of the left eye, the BCVA OD was 0.2 with -7.0C -1.75x75 in the presence of a keratoconus, and the BCVA OS was 0.3 with -10.0C -8.5x85 in the presence of a clear graft. Topography revealed a steep and flat K-value of 49.5D x 180 and 43.3D x 90, respectively.

Having a sufficient endothelial cell density of 699 cells/mm² and anterior chamber depth of 4.09mm, a custom-made Artisan toric phakic IOL was implanted according to the specifications mentioned in figure 2. Topographically induced astigmatism was 0.25D x 90°. This led to an uncorrected visual acuity of 0.5 and a BCVA of 0.6 with -1.5C -1.5 x 150°, and as expected, a high level of satisfaction in the patient.

One year after implantation of the Artisan PIOL, and eight years after the original keratoplasty, a significant change in K-values was noted KS 50.5D x 180, KF 42.3D x 90, leading to a KD of 8.2D x 180 as opposed to a KD of 6.2D x 180 before implantation of the IOI. BCVA OS remained 0.5 with +2.0C -3.5x90, endothelial cell count was 729 cells/mm² and a clear graft and a well fixed toric Artisan PIOL as shown in figure 1 were noted.

Three years after implantation of the toric IOI, 10 years after the keratoplasty, the steepening of the cornea turned out to be ever increasing, KS being 53.6D x 180, KF 40.9D x 90 leading to a KD of 12.7D x 180 as shown by the topography in figure 3. In the presence of a clear graft showing peripheral thinning and slowly progressive cataract formation, BCVA OS was 0.16 with +1.25C -6.5x100.

Discussion
This case study shows progressive steepening following perforating keratoplasty 10 years earlier for keratoconus, possibly based on progression of the keratoconus within the recipient cornea. Based on the situation seven years after corneal graft surgery, a custom-made phakic IOL was implanted with excellent results. As the KD of 6.2D x 180 at the time of implantation changed into KD 12.7D x 180 three years later, BCVA deteriorated, although the progression of the cataract will have played a minor role in this as well. Still, the graft remained clear with an ECD of 727 cells/mm².

Alvarez de Toledo et al. reported in 2003 on changes in astigmatism following initial PKP for keratoconus. An increase of keratometric astigmatism from 10 years after suture removal until last follow-up was noted, as well as a peripheral crescent shaped thinning at the graft host junction. They suggested that increasing astigmatism could be explained by progression of the disease in the host cornea.

Bourges et al. reported in the same year on 12 cases undergoing repeat perforating keratoplasty 10 years after initial perforating keratoplasty for keratoconus. Structural changes in the form of disruption of Bowman’s layer was noted in all donor buttons. This would explain a recurrence of keratoconus characteristics as a result from graft repopulation by recipients’ keratocytes leading to changes in the button.

Figure 1: Custom-made toric Artisan PIOL one year after implantation

Figure 2: Clear graft with peripheral thinning 10 years after keratoplasty for keratoconus

Figure 3: Topography 10 years after keratoplasty (3 years after Artian toric PIOL implantation) showing progressive steepening and signs of pellucid marginal degeneration

Even if the exact mechanism remains unclear, this case study shows that progressive peripheral steepening of the recipient cornea can occur following perforating keratoplasty for keratoconus or pellucid marginal degeneration in late stages, thereby rendering definitive treatment of the astigmatism as occurring immediately after a PKP even more challenging. The most likely cause for this phenomenon appears to be progression of the thinning disorder in the host cornea.