Phakic Intraocular Lens for Keratoconus

Dear Editor:

Keratoconus is a progressive disorder that is characterized by central/paracentral thinning and protrusion of the cornea, causing myopic astigmatism. However, laser in situ keratomileusis is contraindicated for keratoconus eyes because it can induce keratectasia.[1] A phakic intraocular lens (PIOL) can be used to correct myopic astigmatism. The efficacy and safety of PIOL implantation for highmyopic has been studied.[2-5] Herein, we report the outcomes of iris-claw PIOL implantation in eyes with keratoconus.

The study protocol was approved by the institutional review board of the Minamiaoyama Eye Clinic. Thirty-six eyes of 24 patients (13 males and 11 females, 41.8±7.8 year old, −8.61 ± 3.21 D), who underwent PIOL implantation between May 2005 to December 2007, were enrolled. Thirty-two eyes were diagnosed as keratoconus and 4 eyes were diagnosed as pellucid marginal degeneration by videokeratography indices (TMS-IV, Tomey, Aichi, Japan; and OPD-10000, Nidek, Aichi, Japan). Patients with endothelial cell counts less than 1500/mm^2, anterior chamber depths less than 3.0 mm, previous eye surgeries, or other eye diseases were excluded. The toric 5/8.5 lens model was implanted in 15 eyes, the Artiflex 6/8.5 in 10 eyes, and the Myopia 6/8.5 in 11 eyes.

We performed a single laser iridotomy on the peripheral iris at 1 or 11 o'clock at least 1 week prior to the PIOL implantations. Corneoscleral incisions of 6.0 or 6.5 mm for implantation of ARTISAN Myopia or Toric lens models, or a 3.4-mm limbal incision for the Artiflex lens were centered at 12 o'clock. The PIOL was inserted into the anterior chamber, and fixed onto the midperiphery of the iris based on the manufacturer's instructions.

Postoperative examinations were performed on 1 day, 1 week, 1 month, 3 months, 6 months, and 1 year after surgery. For the statistical analysis, analysis of variance, a paired t test and Dunnett test were used. A P value less than 0.05 was considered statistically significant.

Preoperative uncorrected visual acuity logarithm of the minimum angle of resolution (UCVA), 1.39±0.42, improved to 0.07±0.26 on 1 day, 0.04±0.20 at 1 week, 0.02±0.21 at 1 month after surgery, and showed no significant change thereafter ($P<0.001$ at all postoperative examination points; Fig 1; available at http://aaojournal.org). The best spectacle corrected visual acuity (BSCVA) at 1 year after surgery improved by 4 lines in 1 eye (2.8%), 2 lines in 4 eyes (11.1 %), 1 line in 9 eyes (25.0 %), unchanged in 19 eyes (52.8 %), and decreased 1 line in 3 eyes (8.3 %) from the preoperative value (Fig 2; available at http://aaojournal.org). The safety index (postoperative BSCVA/preoperative BSCVA) was 1.16±0.31 and the efficacy index (postoperative UCVA/preoperative BSCVA) was 0.87±0.31 at 1 year after surgery.

Preoperative manifest refraction (spherical equivalents), −8.38±3.42 D (−3.0 ~ −17.875 D) improved to −0.39±0.91 D (−3.75 ~ +2.00 D) at 1 week, −0.42±0.89 D (−3.625 ~ +2.00 D) at 1 month, and showed no significant change thereafter ($P<0.001$ at all postoperative examination points; Fig 3; available at http://aaojournal.org). Manifest refraction at 1 month postoperatively was within 0.5 D of the target refraction in 35 eyes (63.6 %), 1.0 D in 46 eyes (83.6 %), and 2.0 D in 53 eyes (96.4 %). Preoperative astigmatism, 2.44±2.25 D (0 D ~ 8.0 D), improved to 0.93±0.97 D (0 ~ 3.5 D) at 1 week, 0.62±0.69 D (0 ~ 2.5 D) at 1 month, and was stable thereafter.

Except for that 1 eye required resuturing of the wound 1 week after surgery because of wound recession, no intra- and postoperative complications were observed in the follow-up period. Intraocular pressure and central corneal endothelial count was stable and showed no significant change after surgery.

Approximately 86 % of patients answered "satisfied" or "very satisfied" with PIOL implantation at 1 year postoperative examination (Fig 4; available at http://aaojournal.org).

In summary, the 1 year results indicate that PIOL implantation for keratoconic eyes is predictable and effective, and PIOL implantation is one good means for correction of refractive error of keratoconus when BSCVA is not affected.

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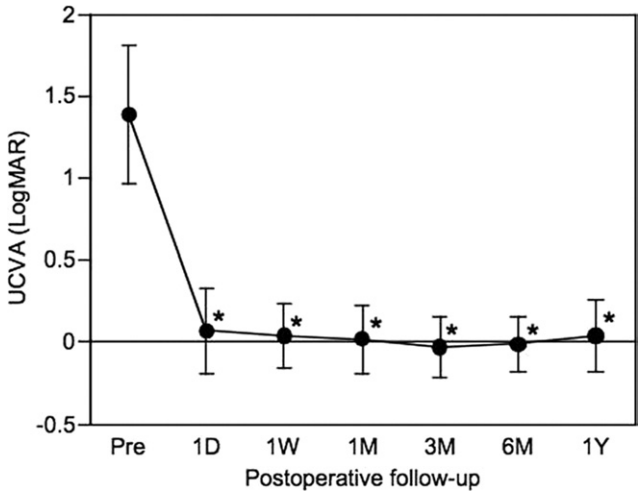

Figure 1. Changes in uncorrected visual acuity (UCVA) after phakic intraocular lens (PIOL) implantation. Uncorrected visual acuity (the logarithm of minimum angle of resolution) is significantly improved at 1 day after surgery, and stable until 1 year after surgery ($P < 0.001$ at all postoperative examination). D = day; M = month; W = week; Y = year. *$P < 0.05$ compared to the preoperative value.

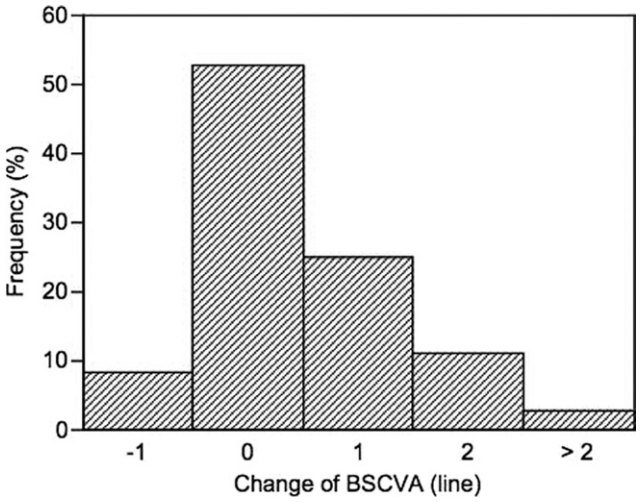

Figure 2. Changes in best corrected visual acuity (BSCVA) at 1 year after phakic intraocular lens (PIOL) implantation. The BSCVA improved more than 2 lines in 1 eye (2.8%), 2 lines in 4 eyes (11.1%), 1 line in 9 eyes (25.0%), was unchanged in 19 eyes (52,8%), and decreased 1 line in 3 eyes (8.3%).

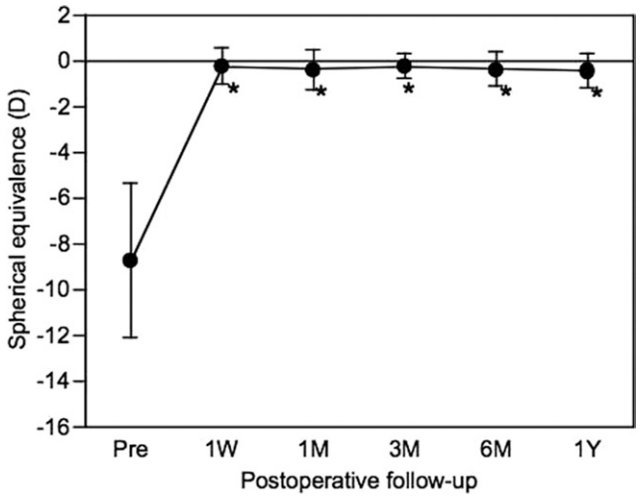

Figure 3. Changes in manifest refraction after phakic intraocular lens (PIOL) implantation. Manifest refraction is decreased shortly after surgery and stable up to 1 year ($P < 0.001$ at all postoperative examination points compared to preoperative value). *$P < 0.05$ compared to the preoperative value. W = week; M = month; Y = year.

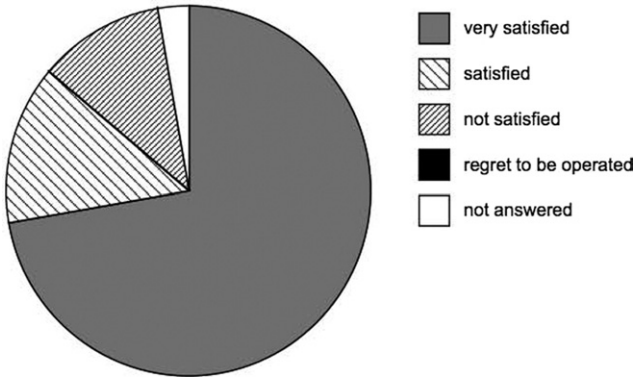

Figure 4. Patient satisfaction at the final examination points. Eighty-six percent of patients answered satisfied or very satisfied with phakic intraocular lens (PIOL) implantation at 1 year postoperative examination.