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Refractive Efficacy of Light Adjustable Intraocular Lenses

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Abstract

Purpose: Light adjustable intraocular lenses (LALs) can provide patients with nearly perfect refractive outcomes after cataract surgery. We performed a study to evaluate the efficacy, predictability and stability of refraction in patients implanted with these lenses.

Methods: Two weeks after surgery, the lenses were irradiated through the cornea with the appropriate spatial intensity profile to correct the patient's refractive errors. Up to two light treatments are used to reach the target emmetropic refraction. Forty-three patients implanted with LALs (Calhoun Vision, Pasadena, USA) were treated and accurately controlled. Seven different irradiance patterns were studied: three to correct defocus, one myopic (M) and two hyperopic (H1,H2); three to correct astigmatism, two myopic astigmatism (MA1,MA2) and one hyperopic astigmatism (HA); and one neutral profile (N). The wave-aberrations of both the whole eye (using a Hartmann-Shack sensor) and the cornea (from corneal topography and ray-tracing) were measured. After each treatment, the refractive changes induced in the lenses were obtained from the wavefront data of the eye and the cornea. Subjective manifest refraction and visual acuity were also measured. All the measurements were performed after every treatment and 3 and 6 months after surgery.

Results: Spherical treatments modified defocus of the intraocular lenses to correct myopia (M) by

-1.38±0.25D and hyperopia by +0.77±0.21D (H1) and +1.50±0.15D (H2). The two myopic astigmatism patterns (MA1, MA2) corrected mixed astigmatism with the same mean value of defocus +0.60±0.3D, but with different amounts of astigmatism, -1.12±0.26D and -1.74±0.39D respectively. The hyperopic astigmatism profile (HA) corrected +1.74±0.35D of defocus and -1.14±0.28D of astigmatism. The effect of the same treatment on different patients presented variability typically within 0.25D. Second adjustments allowed for small refinements leading most patients near practical emmetropia. At 3 and 6 months follow-ups, we didn't find any significant refractive changes in the lenses. Uncorrected decimal visual acuity improved from average values of 0.65 to 0.95 before and after the complete procedure.

Conclusions: Light treatments to adjust LALs correct both sphere and cylinder refractive errors up to around 2D with a precision of 0.25D. The refraction remains stable 6 months after the process is completed. Most treated patients reached final refraction values near emmetropia with an average uncorrected visual acuity around 20/20, improving a 30% from their pre-treatment situation.

Keywords: intraocular lens • cataract • refraction