INTRODUCTION

• Many patients after cataract surgery have significant refractive errors:
  - More than 50% of patients have a spherical equivalent superior to 0.5 D
- Many patients after cataract surgery have a spherical equivalent superior to 0.5 D
  - Most patients have astigmatism in the range 0.5 to 2.0 D
- The retinal image (and visual performance) is mainly degraded by refractive errors (see simulated retinal images below):
- There are two alternatives to improve refractive accuracy in cataract surgery:
  - Better IOL power calculations (see Cánovas et al., ARVO poster 1157) & toric IOLs
  - Light adjustable IOLs (LALs)

METHODS

A group of 77 patients (corneal astigmatism ≤2D) were implanted with Light Adjustable IOLs (Calhoun Vision, Pasadena, USA) and evaluated with an objective Wavefront-guided approach for refractive control through the treatment process.

LALs (Schwartz DM. Light-adjustable lens. Trans Am Ophthalmol Soc. 2003;101:417-36) are similar to standard 3-piece lenses, but contain photosensitive silicone molecules that enable postoperative adjustment of the final refractive power using ultraviolet (UV) light (see figure below for an example of the lens principle).

Light adjustment profiles

After implantation, patients wore spectacles to block UV radiation up to two weeks, when the lenses are irradiated using a digital light delivery (DLD) system. Eight different irradiance patterns were tested:

- Second adjustments used to refine the refraction.
- Two irradiance lock-ins used to stabilize the IOL material.

Objective control of refraction changes

• Objective eye refraction (defocus & astigmatism) was estimated from wavefront measurements obtained with a Hartmann-Shack sensor (HS).
- Control of refraction changes produced by the cornea (from corneal topography & ray-tracing calculations).
- Better control of refractive changes in the LAL by direct subtraction* of corneal and eye data.

Visual Acuity and subjective refraction

Best corrected and uncorrected visual acuity (VA) expressed by decimal units (1/MAR) was measured in every patient and condition.

RESULTS

Example of refraction changes in a complete treatment

Wavefront maps for the complete eye (including defocus & astigmatism)

Visual Acuity and subjective refraction

Average refraction changes in the eye by treatment

CONCLUSIONS

• LAL’s offer an accurate alternative to conventional IOLs to provide patients with predictable and improved refractive errors.
- The refractive range that can be corrected is +2/–2D of defocus and 2.0 D of astigmatism with a precision around 0.5 D for each treatment.
- Visual acuity in the group of patients after light treatments was in average near 1.0 (20/20). These patients are in practice spectacle-free for distance vision.
- After lock-ins, LALs refraction was stable over time (>1 year follow up).
- This technology could also be used to modify higher order aberrations in pseudophakic eyes (See Alcón et al., ARVO presentation 1626, Monday).

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