Evaluation of the Biocompatibility of Intraocular Lens Power Adjustment Using a Femtosecond Laser

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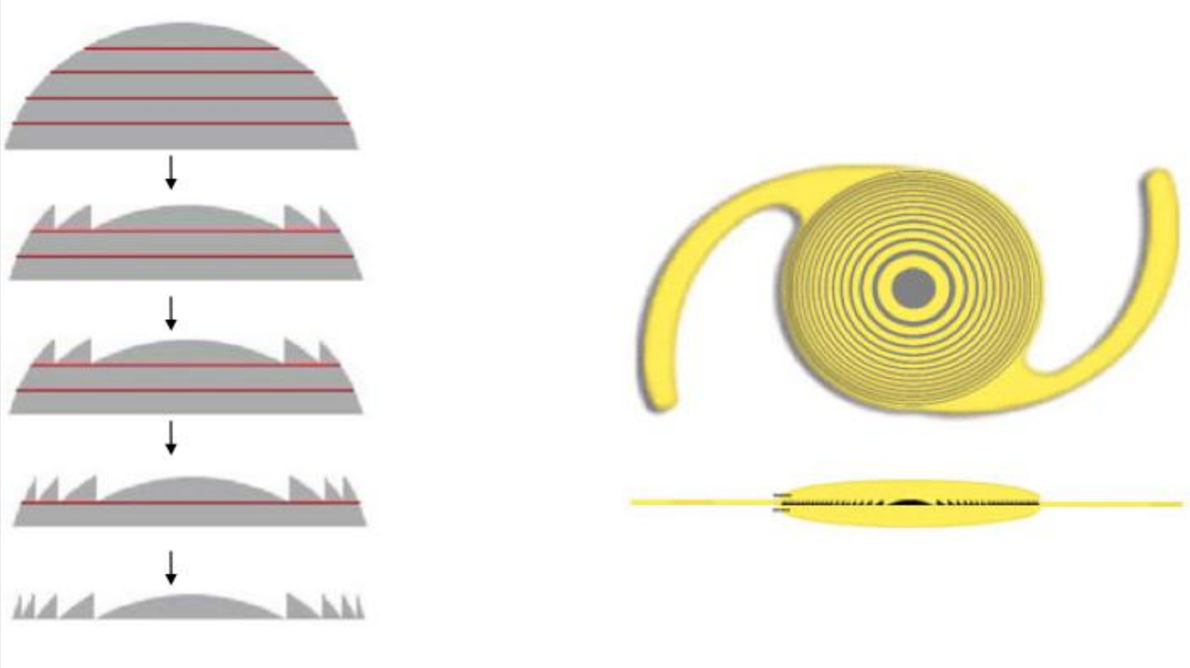
Purpose

- The use of a femtosecond laser to alter the hydrophilicity of targeted areas within an intraocular lens (IOL) creates the ability to build a refractive index shaping lens within an existing IOL

- Phase-Wrapped Structure
  - Contains entire curvature of traditional convex or concave lens in **one layer**
  - Creates significant refractive change in limited area
    - Refractive index change of 0.01 in a conventional lens = 0.4 D change
    - Refractive index change of 0.01 in a phase-wrapped lens= 3.3 D



Purpose

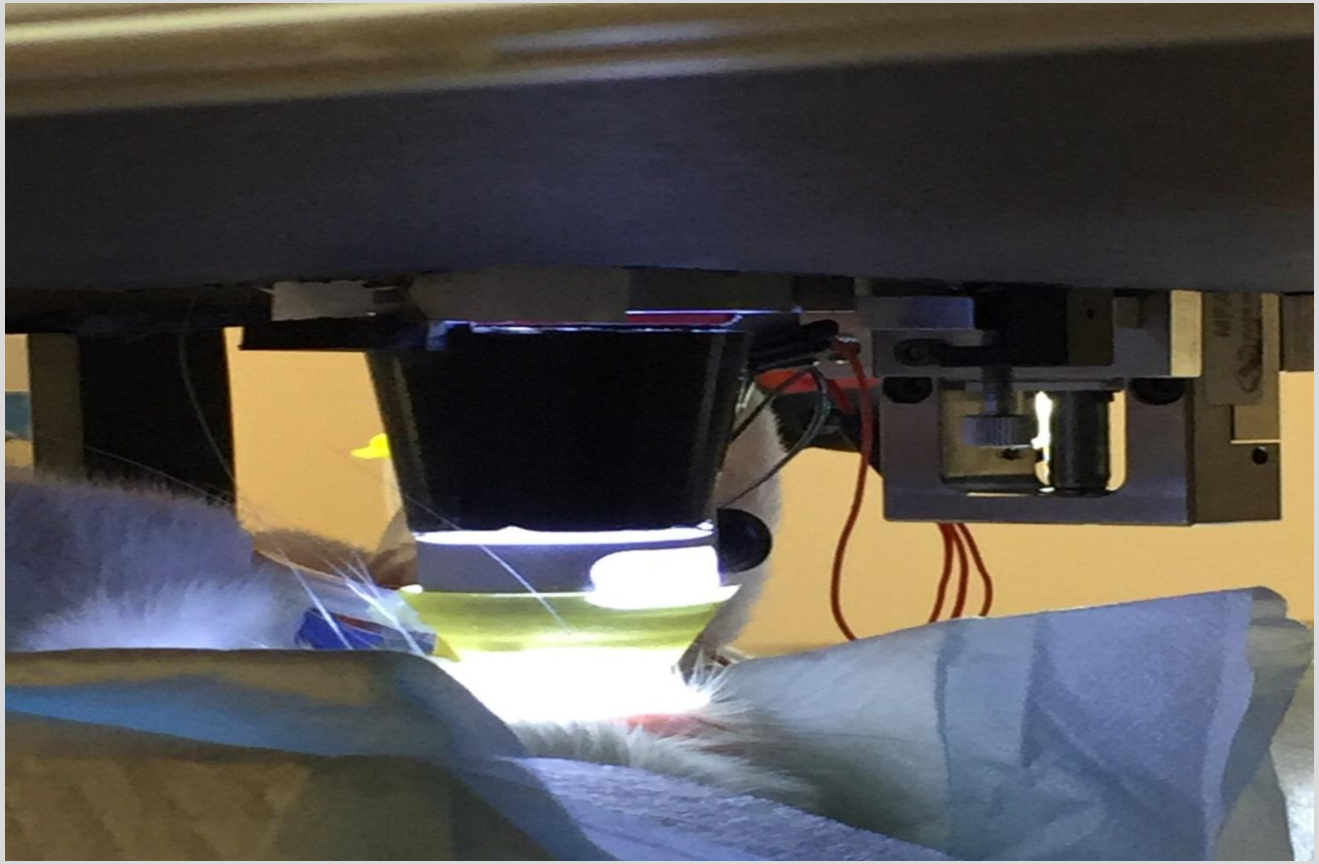
- The object of this study was to evaluate the biocompatibility (uveal and capsular) of an IOL following power adjustment by a femtosecond laser
- The postoperative IOL power adjustment following treatment with the femtosecond laser was evaluated

Methods

- 6 rabbits underwent phacoemulsification with implantation of a commercially available, hydrophobic acrylic IOL in both eyes
- Postoperative power adjustment was performed using the femtosecond laser 2 weeks following implantation in one eye

Methods

- Alignment and docking of the eye was performed under the control of a camera and OCT system of the laser
- An interface was specially designed for use in the study based on previous studies regarding the size and geometry of the rabbit eye
- The treatment was designed to adjust the spherical power by 3.6 diopters and the duration was 23 seconds



Methods

- The animals were followed clinically with slit lamp examinations for an additional 4 weeks to assess for signs of any postoperative inflammation or toxicity

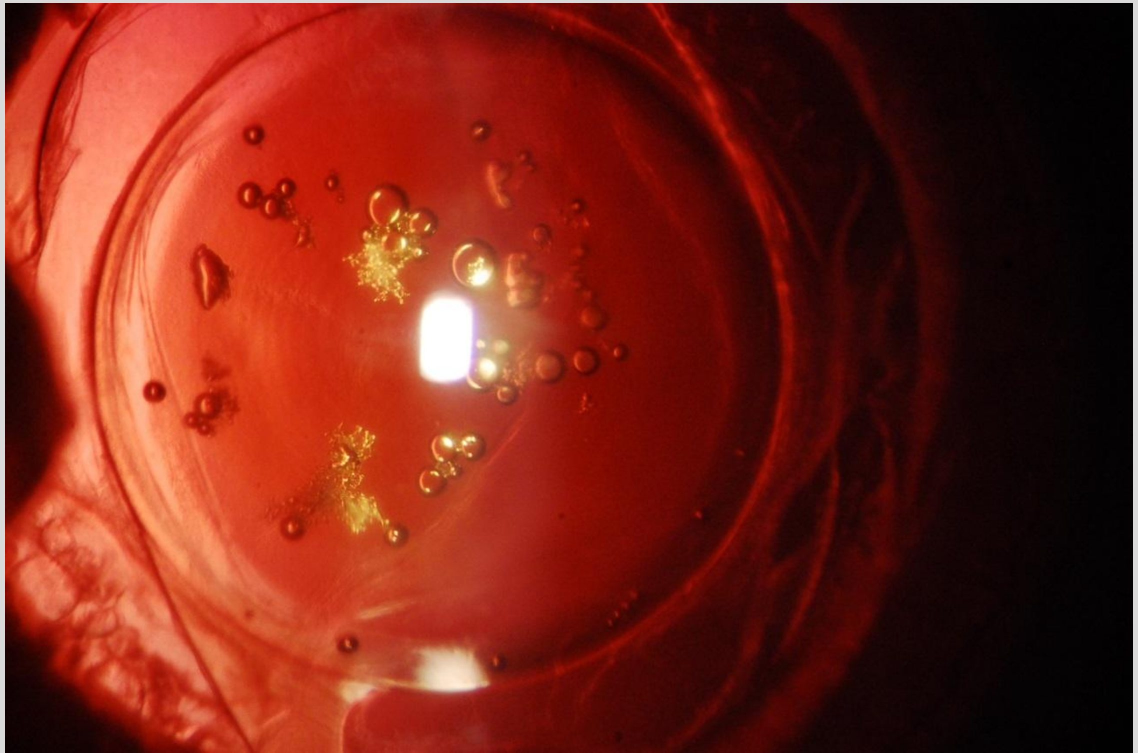
- The rabbits were humanely euthanized and the globes enucleated

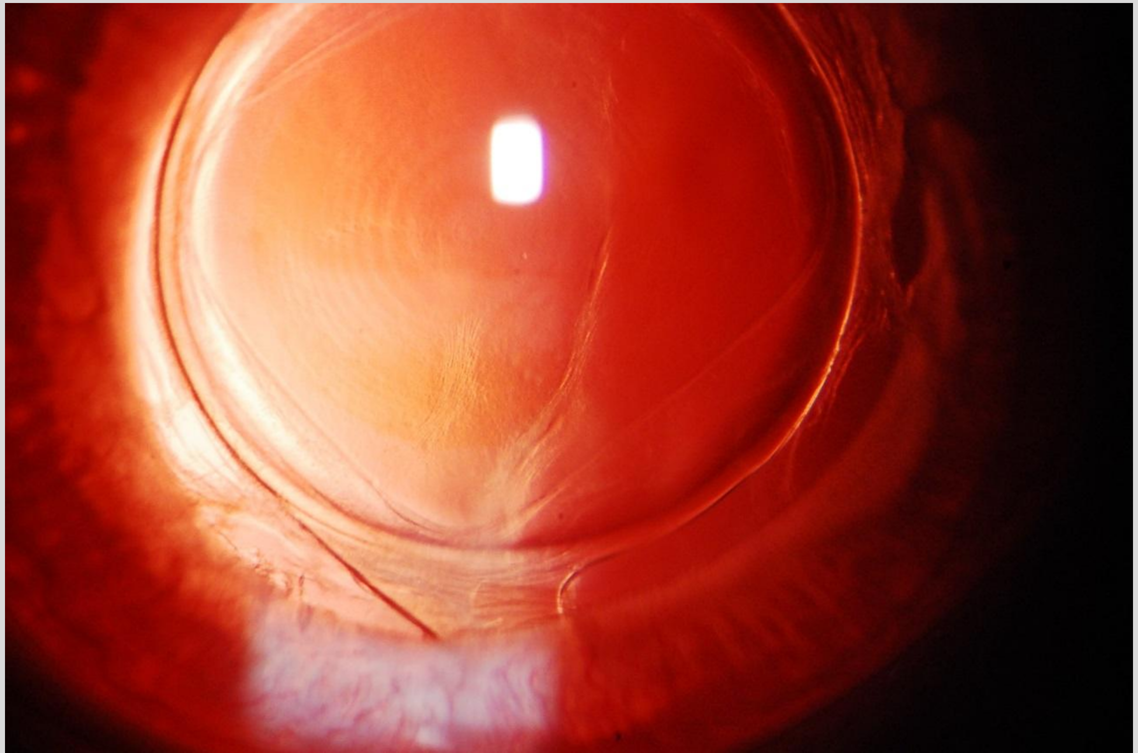
Methods

- The globes were bisected coronally and gross examination and photographs from the posterior aspect (Miyake-Apple view) were performed to assess anterior capsular opacification and fibrosis as well as posterior capsular opacification
- The IOLs were explanted for measurement of the achieved power change
- The globes were then sectioned and processed for standard light microscopy with hematoxylin-eosin staining

Results

- Slit lamp examination performed after laser treatment showed the formation of small glass bubbles behind the lens which disappeared within a couple of hours





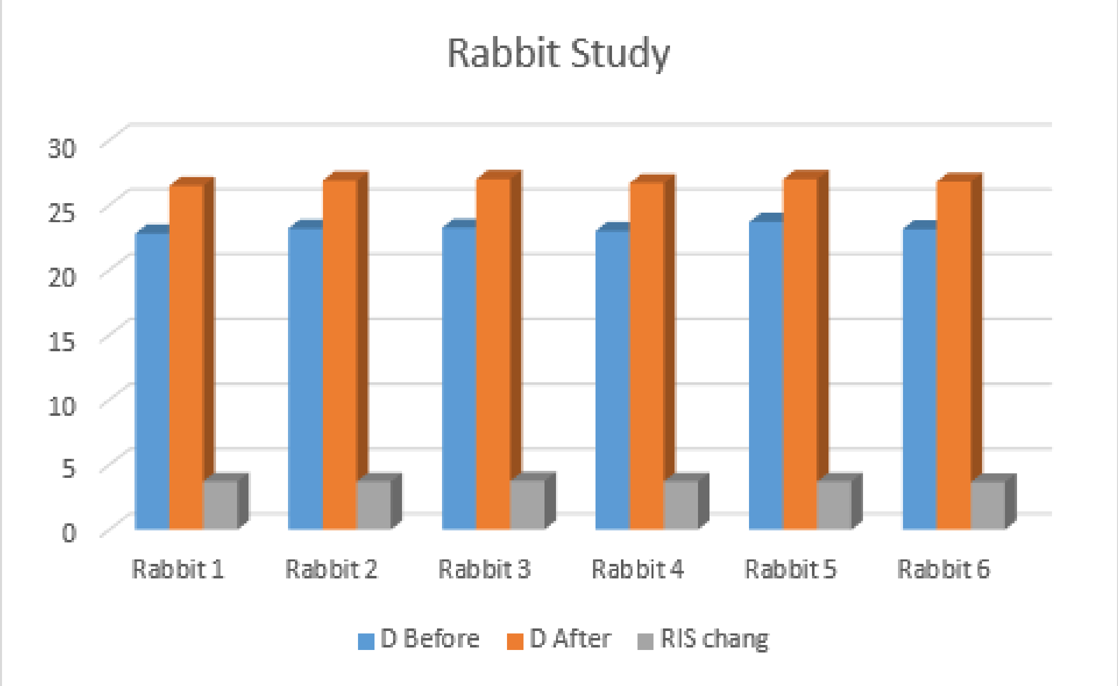
Results

- No postoperative inflammation or toxicity was observed in the treated eyes on slit lamp examination and on Miyake-Apple view of the globes when compared to non treated eyes
- Histopathologic evaluation revealed no signs of postoperative inflammation or toxicity when comparing the study eyes to the non treated control eyes

Results

- After explantation evaluation of the lenses confirmed that the change in power obtained was consistent and within 0.1 diopter

Moran ID	283	287	282	284	285	286
	Rabbit 1	Rabbit 2	Rabbit 3	Rabbit 4	Rabbit 5	Rabbit 6
D Before	22.8	23.2	23.25	23	23.7	23.15
D After	26.5	26.9	27	26.7	27	26.8
RIS chang	3.7	3.7	3.75	3.7	3.7	3.65



Conclusions

- Consistent and precise power changes can be induced in the optic of commercially available hydrophobic acrylic lenses in vivo by using a femtosecond laser
- Results show that the laser treatment of the IOLs was biocompatible in the rabbit model