

# Comparison of Pupil Size, Glare and Visual Outcome in a Group of Patients Eighteen Months to Two Years After Cataract Surgery.

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## AIM:

To investigate the effect of pupil size and IOL edge design as factors influencing glare induced changes in visual acuity.

## BACKGROUND:

The unit shared concerns on sharp edge design<sup>2</sup> with respect to glare induced by incident light at certain angles<sup>3</sup>, causing patient complaint. We acknowledge the retarding effect of this design on lens epithelial ingrowth onto the posterior capsule but attempt to quantitate these effects in relation to pupil size and using visual acuity as a function to quantitate glare.

## DESIGN:

Non-randomised retrospective study.

## METHOD:

Sixty-five patients, who underwent uncomplicated small incision cataract and foldable lens surgery, between January 2000 and June 2000 were recalled. Patients underwent 2.5mm steep axis incision, followed by continuous curvilinear capsulorhexis of between 5 and 5.5 mm in diameter. A divide and conquer phacoemulsification technique was used with cortex aspiration and posterior capsular polish. No anterior capsular polishing was performed. IOLs were implanted through minimally enlarged wounds unless necessary for as-

tigmatic control. Sutureless wound hydration techniques were used for wound closure. Intra-ocular Gentamycin and adrenalin are the only additives used. Surgical time was approximately fifteen minutes.

Patients included in the study were measured to have best corrected visual acuities of 6/9 or better, at the two-week postoperative visit, following uncomplicated surgery only.

The following was the distribution of lenses within the group:

- Ten Ciba vision MemoryLens CV232; Hydrophilic acrylic; Round edge design
- Twelve Lenstec SofTec I; Hydrophilic acrylic; Sharp edge design
- Eighteen Alcon Acrysof MA 60 BD; Hydrophilic acrylic; Sharp edge design
- Eleven Alcon Acrysof MA 30 BA; Hydrophilic acrylic; Sharp edge design

The following examination parameters were documented:

- Visual acuity
- Intra-ocular pressure
- Pupil sizes as measured by Procyon dynamic pupilometer under scotopic and mesopic conditions
- Anterior chamber clarity (cells, flare)
- Glare (as produced by light shin-

ing at 45 degree into the patients eye and creating mesopic high conditions as defined by Procyon and objectively observed as loss in visual acuity, subjectively observed by patient questioning).

- Anterior capsular assessed for size of CCC and clarity
- Posterior capsular changes (graded from 0 to 3), capsule or Nd:YAG posterior capsulotomy, and
- Optic transparency (The optic transparency was assessed for surface changes and intrinsic changes, haziness, milkiness, glistenings. Glistenings was graded from 0 to 3.)

## RESULTS

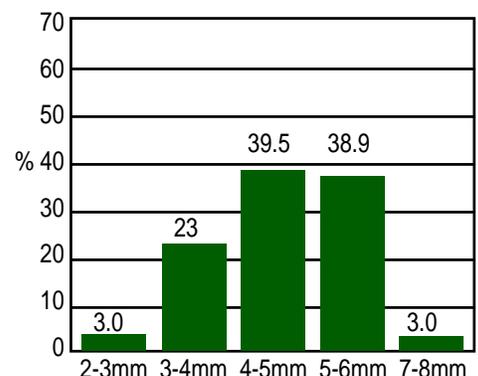
### Pupil Size

#### (Procyon pupilometer1):

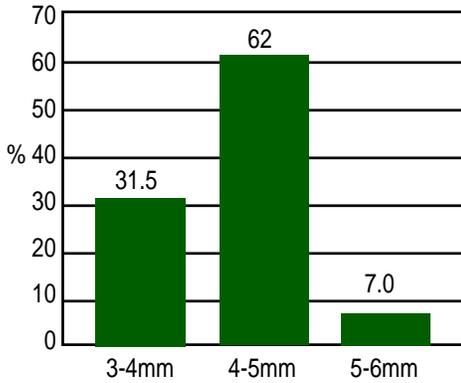
The Procyon dynamic pupilometer allows the measurement of the pupil size under scotopic and mesopic conditions.

#### Scotopic

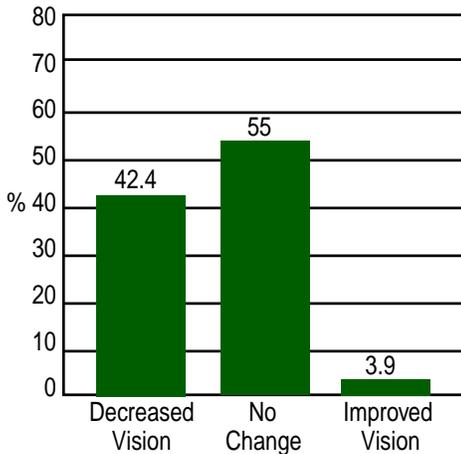
Fig. 1 Distribution of pupil size under scotopic (0.04 Lux) conditions:



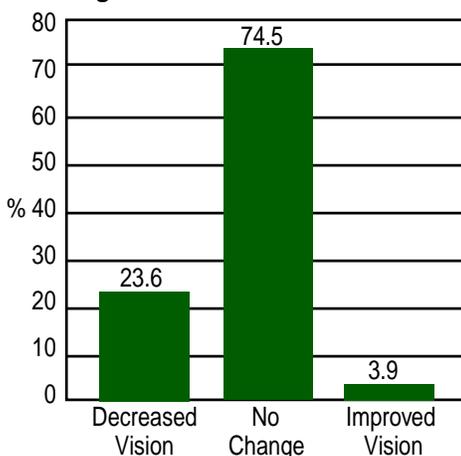
**Fig. 2 Pupil size - mesopic high conditions (4 Lux):**



**Fig. 3 Objective measurement of glare:**

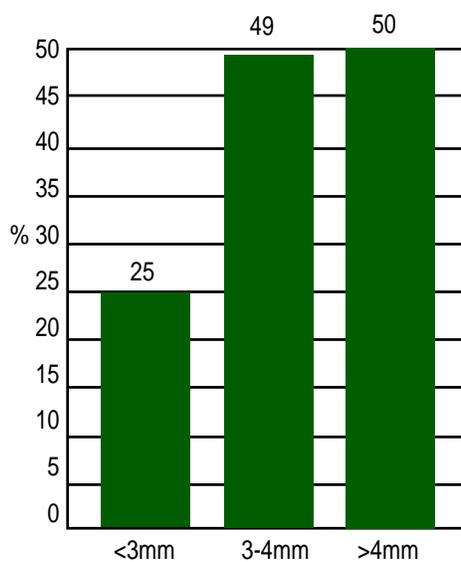


**Fig. 4 Subjective measurement of glare:**



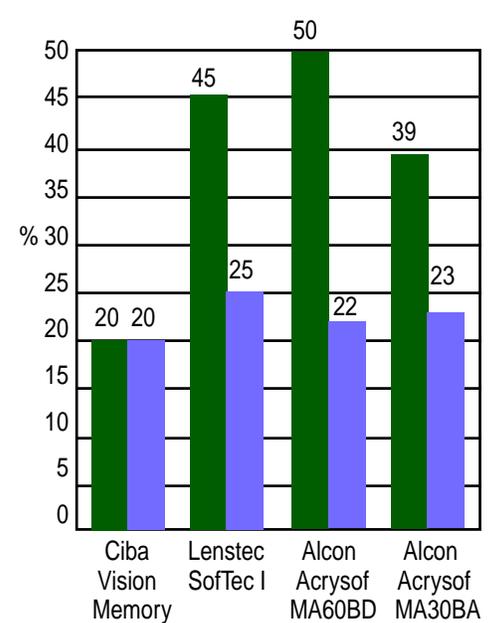
- Aware of decreased vision with glare: 12 (23.6%)
- No change in vision with glare being introduced: 36 (74.5%)
- Improvement in vision with glare being introduced: 1 (1.9%)
- Two of the patients with subjective glare had no change in their objective vision.

**Fig. 5 Correlation between pupil size and glare:**



- Mesopic pupil size smaller than 3mm and glare: 4 patients had glare visual loss out of 16 (25%)
- Mesopic pupil size between 3 and 4 mm and glare: 15 patients had glare visual loss out of 31 (49%)
- Mesopic pupil size bigger than 4 mm and glare: 2 patients had glare visual loss out of 4 (50%)

**Fig. 6 Correlation between glare and lens type**



	Objective	Subjective
Ciba Vision Memory	20%	20%
Lenstec SofTec I	45%	25%
Alcon Acrysof MA60BD	50%	22%
Alcon Acrysof MA30BA	39%	23%

**CONCLUSION:**

The new Procyon dynamic pupilometer is a very useful addition in the diagnostic tools available to the cataract surgeon. It allows us to take reliable measurements of the pupil size under different lighting conditions. We created similar ambient lighting conditions, as is created by the pupilometer under mesopic high conditions. Measured the vision under these mesopic high conditions. We postulated that the pupil size would be the same as measured by the pupilometer under these similar lighting conditions. In this study we attempted to confirm the correlation between pupil sizes and glare and lens edge design and glare.

In figure 5, the correlation between pupil size and glare, as we observed it objectively, shows a higher percentage of patients with visual loss, as the pupil size increases. This confirms an increase in glare with larger pupil sizes. The percentages of patients with glare visual loss increases as the pupil size increases. This was also true for the subjective observation, although the total number of patients that were aware of glare was much less (42.1% objective vs 23.6% subjective).

The results demonstrate that the edge design of the lens plays an important roll in glare. In figure 6

the objective perception of glare was about twice as much in the lenses with a square edge lens design. The question of subjective glare was, interestingly enough, much closer for the different lens groups. The MemoryLens still had the smallest percentage of symptomatic patients.

Not one of the patients in our study complained of glare without being prompted.

Two patients had improved vision with glare, most probably due to the pinhole effect of miosis.

Fewer patients were aware of glare, subjectively, than we could detect objectively. Also, two of the patients with subjective glare, were not positive objectively. This demonstrates the variability in the interpretation of symptoms

### DISCUSSION:

Glare, in the eye, can be defined as a degradation of retinal image contrast caused by extraneous light scattered within the eye by

media translucencies, causing a spectrum of responses, varying from no effect to unpleasant sensation and loss of visual acuity. Glare is a multifactorial phenomenon and is influenced by numerous factors among other by the tear film, cornea, pupil size, iris properties, lens material and design, capsular changes and vitreous changes. We tried to quantify glare in comparison to pupil size. The testing of glare<sup>1</sup> has not been standardised and we used a simple method to produce glare in the eye. Our patient selection attempts to standardise variables in order to compare only the influence of the intra-ocular lens and pupil size.

Lenses have been removed<sup>4</sup> for intolerable glare, but invariably patient understanding of the cause of the glare improves the tolerance of symptoms. Only one of the patients complained excessively of glare induced frustration, but his symptoms were tolerable after Nd:YAG posterior capsulotomy was performed, reducing the glare phenomenon

from intolerable to acceptable.

In our study we show that edge design is an important factor in glare production. All of the lenses we used have undergone refinement or are in the process of undergoing refinement since our study was done to reduce glare.

### REFERENCES:

1. Assessing the reliability, discriminative ability, and validity of disability glare test, Elliot DB, Bullimore MA Investigative Ophthalmology & Visual Sciences 34(1): 108, Jan. 93
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