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Original Research Article

A Hospital Based Visual Outcome Assessment of Single Piece Yellow Tinted Hydrophobic Acrylic Intraocular Lens

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Abstract

Aim: To evaluate the visual outcome of single piece yellow tinted hydrophobic acrylic intraocular lens (IOL) following phacoemulsification.

Materials and methods: This prospective observational study was conducted in the Department of Ophthalmology, Bhagwan Mahavir, Institute of Medical sciences, Pawapuri, Nalanda, Bihar, India and private hospital for 1 year. Patients aged 50 years and above whose visual loss can only be attributed to cataract in an otherwise healthy eye were enrolled in the study.

Results: The mean ± SD of manifest refraction spherical equivalent at day 180 was 0.9±0.86. Results indicate that single piece yellow tinted hydrophobic acrylic intraocular lenses significantly improve contrast sensitivity function (p=0.000).

Conclusion: Implantation of single piece yellow tinted hydrophobic acrylic IOL provides expected visual outcome, refractive stability, enhances contrast sensitivity with minimal glistening, glare and adverse events. The square edge design of the hydrophobic lens reduces incidence of posterior capsular opacification.

Keywords: hydrophobic acrylic, intraocular lens, phacoemulsification

Introduction

Recent advances in intraocular lens (IOL) material and design offer enhanced treatment options to surgeons and patients. As excellent visual and refractive outcomes have become more expected, increased awareness has focused on visual and refractive stability and on reductions in posterior capsule opacification (PCO) and glistenings. Although neodymium: yttrium aluminium garnet (Nd: YAG) capsulotomy is generally performed in-office with a high index of safety, it can result in complications. [1-4]

The visual significance of glistenings, fluid-filled microvacuoles that form within the IOL optic when in an aqueous environment, [5] is a matter that has been actively investigated.

Yet acrylic lenses cannot reproduce retinal protection of natural biological lens in preventing photo toxicity of retina by blue light. This paved way for the development

of yellow tinted intraocular lenses. The yellow tinted blue blocking intraocular lenses conferred protection to retina by absorption of short wavelength light mimicking natural biological lens. [6] Square edge design of the haptic provided added advantage of reducing incidence of posterior capsular opacification. [7]

Supraphob BBY Yellow tinted blue blocking IOL (Appasamy Associates) have been designed to provide good visual acuity, enhance contrast sensitivity, confer retinal protection and reduce posterior capsular opacification. This study aims to evaluate the clinical performance of the single piece supraphob Yellow tinted hydrophobic acrylic intraocular lens by analyzing visual acuity, contrast sensitivity, refractive stability, glistening, glare, adverse events and the influence of square edged design in reducing posterior capsular opacification.

Thus, we aim to evaluate the visual outcome of single piece yellow tinted hydrophobic acrylic intraocular lens (IOL) following phacoemulsification.

Materials and methods: This prospective observational study was conducted in the Department of Ophthalmology, Bhagwan Mahavir, Institute of Medical sciences, Pawapuri, Nalanda, Bihar, India and private hospital. for 1 year. Guidelines of declaration of Helsinki were followed in the conduct of the study.

Patients aged 50 years and above whose visual loss can only be attributed to cataract in an otherwise healthy eye were enrolled in the study. Written informed consent was obtained from eligible subjects. Preoperative UDVA (uncorrected distance visual acuity) & CDVA (corrected distance visual acuity) measured and documented in log MAR (logarithm of minimum angle of resolution) visual acuity values, Contrast sensitivity measured by Pellirobson chart, Refraction by Topcon Auto refraction, Intraocular pressure measurement with goldmann applanation tonometry, Corneal thickness with ultrasound pachymetry and Keratometry measurements by Topcon KR 8900. Intraocular lens power calculated using Axis Nano. Appropriate SRK II / SRK T or Holladay formula applied depending upon the keratometry and axial length values to calculate intraocular lens power. Surgeon factor considered and accounted while calculating intra-ocular lens power. A standard method of anterior and posterior segment evaluation was followed.

Routine pre-operative investigations and sterile precautions followed. All surgeries were done by single surgeon. Optikon pulsar minimum stress phacoemulsification machine with 45-degree kelman tip was used for the procedure. All patients underwent clear corneal incision performed with 2.8 mm keratome (optiedge, Appasamy manufacturers). Appropriate nucleus fragmenting and emulsification techniques employed depending upon the density of the nucleus. Following completion of nuclear removal, single piece Supra Phob – BBY yellow tinted hydrophobic acrylic aspheric 360- degree square edged intraocular lens (Appasamy Associates) was inserted utilizing an injector system.

Surgical details including Intra operative Complications were noted. Post-op antibiotic- steroid combination eye drops with cycloplegenic medications prescribed. Follow up evaluation was performed on day 1, day 3, day 7, 1 month, 2 months and 6 months post operatively.

Post-operatively uncorrected distance visual acuity and corrected distance visual acuity was recorded in LogMAR values, evaluation of contrast sensitivity was performed by pelli-robson chart and scored between 0 to 2. Score of 2.0 denotes normal contrast sensitivity of 100%. Less than 1.5 (75%) is consistent with visual impairment and the score of less than 1.0 (50%) represents visual disability. [8-9] Manifest refraction assessed by Topkon

KR8900 auto refractometer and documented in spherical equivalent.

The incidence and the severity of glistening were evaluated using slit lamp beam set at 10 X 2 mm^2 with an angle of 30^0, glistening's are graded by the method followed by Tognetto et al. [10] Number of glistening per field at 25 x magnification on slit lamp were noted and graded from 0 to 3. Glistening grade 0 (absent); grade 1 (trace); grade 2 (moderate) and grade 3 (severe).

Glare evaluation performed as advocated by TH Williamson et al. [11] After the initial assessment of contrast sensitivity using pelli-robson chart, glare introduced by pen torch held at 20 degrees to visual axis at 30cm directed at pupil and contrast sensitivity subsequently measured under influence of glare. As the pelli-robson chart gives logarithmic measure of contrast sensitivity, the effect of glare upon contrast sensitivity was obtained directly by difference in values before and after introducing glare. Values denote glare disability.

Posterior capsule opacification was evaluated by a grading system, followed by Kruger AJ et al. [12] The 3 mm optic zone behind the intraocular lens was assessed for posterior capsular opacification by slit lamp and graded from 0 to 3, grade 0 being absent, grade 1 very mild, grade 2 moderate. Dense white opacities were graded as grade 3.

Results:

In our study the variability of manifest refraction spherical equivalent was maximum between post-operative day 1 to day 3 as depicted in table 1. In further follow-up visits, refractive spherical equivalent remained stable and the mean ± SD of manifest refraction spherical equivalent at day 180 was 0.9±0.86.

135 patients (97%) had a preoperative score of <1.0 and 4 patients had a preoperative contrast sensitivity score of 1.0-1.5. Table 2 shows contrast sensitivity measurements in preoperative and postoperative follow-up visits. Pre-operatively none of the patients had good contrast sensitivity scores of above 1.5. Following cataract removal and intraocular lens implantation contrast sensitivity scores significantly improved. At 180 days, contrast sensitivity scores of 139 patients was between 1.5-2.0. Results indicate that single piece yellow tinted hydrophobic acrylic intraocular lenses significantly improve contrast sensitivity function (p=0.000).

Adverse events can be considered under cumulative and persistent. In our study cumulative adverse events included corneal edema, subconjuntival haemorrhage, postoperative uveitis and postoperative rise in intraocular pressure. No persistent or serious adverse events encountered in our study. No secondary surgical intervention was required in any of our patients. Distribution of adverse events is depicted in Table 3. Out of 25 patients having adverse events, 7 patients had multiple adverse events. 6 patients had corneal edema and increase in IOP, 8 patients had corneal edema and sub conjunctival haemorrhage and 4 patients had corneal edema at first postoperative day and uveitis at postoperative day 30.

Table 1: Mean visual and refractive outcome

Parameter	Pre op	Day 1	Day 3	Day 7	Day 30	Day 60	Day 180	F Value	P value
UDVA in LogMAR Mean± S.D	0.86 ±0.36	0.17± 0.08	0.17± 0.08	0.13± 0.05	0.14± 0.07	0.16± 0.04	0.15± 0.06	389.52	0.000**
CDVA in LogMAR Mean± S.D	0.65 ±0.25	0.10± 0.14	0.02± 0.09	0.07± 0.08	0.08± 0.09	0.06± 0.05	0.06± 0.08	792.63	0.000**
MRSE Mean± S.D	-2.63±1.80	0.07±0.96	0.14±0.92	0.09±0.80	0.05± 0.89	0.08±0.85	0.9±0.86	103.59	0.000**

Table 2: Contrast sensitivity measurements pre-operative and post-operative

Contrast Sensitivity	Pre op	Day 1	Day 3	Day 7	Day 30	Day 60	Day180	Chi square	P Value
1.5-2.0	0	124	139	138	135	139	139	965.82	0.000**
1.0-1.5	4	16	1	2	5	1	1		
<1.0	135	0	0	0	0	0	0		

Table 3: Distribution of adverse events

Adverse events	N	%
Increase in IOP (>21mm Hg)	7	
Corneal (K) –Edema	6	
SCH (Sub conjunctival Haemorrhage)	8	
Uveitis	4	
No Adverse events	115	
Total	140	100

Discussion:

Report by Ueda et al. [13] showed that there was no significant difference between clear and yellow IOLs for either MD or PSD. They compared the Hoya VA60BB (clear IOL) with Hoya YA60BB (yellow IOL). The results from FDT perimetry were also not influenced by the color of the IOL.

FDT perimetry predominantly stimulates the magnocellular pathway by using frequency doubling illusions. Rod cells may transit signals to the lateral geniculate body through the magnocellular pathway of ganglion cells. This theory was suggested by three articles. As repoted by Lee et al. [14], rod inputs were much more apparent in magnocellular pathway cells. Purpura et al. [15] stated that the Magnocellular pathway is the predominant conveyor of information of spatial contrast to the visual cortex in the mesopic and scotopic illuminations. Sun et al. [16] reported that rod threshold areas are inferred to be mediated by the

magnocellular pathway. As a result, we can assume that a frequency doubling illusion predominantly stimulates rod cells. Sensitivity of cones and rods varies in some conditions. First, the illuminance level determines the level of activity of photoreceptors. Rods are more active photoreceptors in scotopic conditions. Secondly, rod cells are more sensitive than cone cells in short wavelength light. Stabell and Stabell [17] suggested that the "rod color" is blue. Therefore, if a short wavelength blue ray light was blocked by the yellow tinted IOL, we can assume that the result of FDT perimetry would be altered.

In another study by Kim W et al. [18] measurements were taken uniocularly for post-operative (phacoemulsification) patients with a spherical AcrySof MA30 IOL and aspheric acrylic Tecnis ZA9003 IOL. Study included 9 individuals with a spheric AcrySof IOL, 19 individuals with a spherical foldable IOL, and 24 individuals with an aspheric foldable IOL. Visual acuity component was measured by using LogMar notation. The myopic shift (myopic refractive error) and depth of focus were evaluated in that way. Results showed that patients with an aspheric foldable IOL had less spherical aberration and better vision quality as compared to others. Eyes with an aspheric IOL had a smaller myopic shift than eyes with other IOLs. Study mentioned similar results to our study outcomes, visual acuity and visual performance was better when fitted with and aspheric IOL. [18]

Christiansen et al [19] reported that the Snellen acuity in eyes with severe glistenings (grade $2+) was half a line lower than in eyes with mild glistenings (P=0.01), a finding supported by other studies. [20-21] Investigations involving other hydrophobic acrylic IOLs have reported that glistenings appear to increase in severity with time, [22-24] which was not found with the MX60 IOL. The MX60 IOL is packaged in physiologic saline to eliminate fluid exchange with the aqueous humor. Prehydration of this IOL to equilibrium water content ensures that it remains glistening-free. Following cataract surgery, a pristine IOL is clearly the ideal outcome.

Our study utilized yellow tinted hydrophobic acrylic aspheric intraocular lenses and we believe that similar factors and design modifications, significantly improved contrast function in our operated patients. Our study was conducted in a standard clinical environment utilizing PelliRobson chart. Mainster opines environmental, clinical and photic conditions affect contrast sensitivity. [25] This factor has not been considered in our study and a different environment or lighting state or different method of evaluation by functional acuity charts may have altered the outcome of our study. [26]

Conclusion:

Implantation of single piece yellow tinted hydrophobic acrylic IOL provides expected visual outcome, refractive stability, enhances contrast sensitivity with minimal glistening, glare and adverse events. The square edge design of the hydrophobic lens reduces incidence of posterior capsular opacification.

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