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Research Article

Comparative Study of Multifocal Versus Monofocal Lenses after Cataract Extraction Surgery

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Abstract: The lens is a highly organised, transparent structure that has evolved to alter the refractive index of light entering the eyes. With the practice of cataract extraction surgery and intraocular lens (IOL) implantation good unaided distance visual acuity is now a realistic expectation post-surgery. Monovision does not allow full advantages of binocularity, including stereopsis at near. Multifocal lenses provide multiple 'point of focuses' and thus provides a good distance and near visual acuity. The aim of this study was to compare and assess the effect of multifocal and monofocal IOL with reference to visual acuity both distant and near, to compare and assess the effect of multifocal and monofocal IOL with reference to contrast sensitivity, to compare and assess the effect of multifocal and monofocal IOL with reference to spectacle independence, and to compare and assess the effect of multifocal and monofocal IOL with reference to complaints of glare and halos and patient's visual satisfaction. Thus it was concluded that the distance vision without glasses was almost similar in both groups, near vision without glasses was better in the multifocal group, complaints of reduced contrast sensitivity were found in the multifocal IOL group as compared to monofocal IOL group at low contrast levels, patients with multifocal IOL implant achieved spectacle independence more often, there was no significant difference between the multifocal and monofocal IOL groups with respect to complaints of halos and glare, patients overall satisfaction with vision was high and equal across the two groups, and revealing that adequate counselling can lead to patient satisfaction regardless of spectacle independence or photic phenomena.
Keywords: Cataract, Monofocal, Multifocal, Intraocular Lens (IOL), Vision.

INTRODUCTION

The lens is a highly organised, transparent structure that has evolved to alter the refractive index of light entering the eyes [1]. Cataract is a most common cause of blindness in India [2]. With the practice of cataract extraction surgery and IOL implantation good unaided distance visual acuity is now a realistic expectation post-surgery. Near vision, however, still requires additional refractive power, usually in the form of reading glasses. This is because the replacement lens had one 'point of focus', for distance only.

Monovision does not allow full advantages of binocularity, including stereopsis at near. However, with recent advances in technology and newer development in the field of intraocular lens good unaided distance and near vision has become a reality.

Multifocal lenses provide multiple 'point of focuses' and thus provides a good distance and near visual acuity. These are designed to avoid the need for glasses.

Multifocal lenses are generally either refractive or diffractive [3]. The optics of a refractive multifocal lens is based on the refraction of light at the lens optic, obeying Snell's law of refraction. The lens consists of concentric zones, of which each has a different power. In, principle, their performance depends on pupil size and centration of the lens; however this can be reduced by increasing the number of zones and by aspherizing the zone transitions.The optics of diffractive multifocal IOL is based on the constructive and destructive interference of the light [4-6]. The lenses generate two main focal points in which the majority of the incoming light is focused [8, 9].

Multifocal IOLs have been under development, clinical study and implantation for more than 20 years [7, 10]. But multifocal IOLs have their drawbacks. With implantation of these IOLs some

patients complain of decreased contrast sensitivity, glares and halos [6]. Hence, there is a need to study whether the benefit of the multifocal IOLs outweighs this optical compromise inherent to multifocal IOL [5].

The aim of this study was to: a) To compare and assess the effect of multifocal and monofocal IOL with reference to visual acuity both distant and near, b) To compare and assess the effect of multifocal and monofocal IOL with reference to contrast sensitivity, c) To compare and assess the effect of multifocal and monofocal IOL with reference to spectacle independence, d) To compare and assess the effect of multifocal and monofocal IOL with reference to complaints of glare and halos and patient's visual satisfaction.

MATERIALS AND METHODS

Inclusion criteria

Patient's with senile cataract without any ocular pathology.

Exclusion criteria

Congenital, traumatic and complicated cataract, patients with ocular pathology other than cataract (high myopia, diabetic retinopathy, hypertensive retinopathy, uveitis, or any other posterior segment pathology), patients who have undergone any previous ocular surgery in the operating eye, patients who have been operated for cataract in other eye, professional night drivers, those with high post-operative expectations, astigmatism greater than 1D, pupil size less than 2.5mm, patients with any intra-operative complications like posterior capsular tear and other complications which hinders proper IOL centration, patients with pre-existing posterior capsular opacification

IOL used

Monofocal IOL used in the study is a hydrophobic acrylic 1-piece IOL with 6.0mm optic diameter with an overall diameter of 13mm.

Multifocal IOL used in the study is a diffractive hydrophobic acrylic 1-piece IOL with 6.00mm optic diameter [4] with an overall diameter of 13 mm with a total near add power of + 2.5 Diopter or +3 Diopter depending upon the patient's lifestyle.

Pre-operative evaluation

Relevant history of the patient was noted in detail. Thorough clinical evaluation done which included visual acuity examination, slit lamp examination, fundoscopy with direct and indirect ophthalmoscope and 90 D, intraocular pressure measurement with applanation tonometer and lacrimal sac syringing. Keratometry was done on manual keratometer and was confirmed on automated keratometer. Contact ultrasound biometry was performed in allcases for axial length measurement. Emmetropic IOL power was determined with Holladay 1, Haigis, and Hoffer Q formula.

Operative notes

Standard phacoemulsification was done through 2.8mm clear corneal incision by a single surgeon. Proper centration of the IOL was achieved with the anterior capsule covering about 0.5 mm rim of IOL

Post-Operative follow-up

It was done on 1stday, 7th day, 1 month and 6 months post-surgery. Distance vision (snellen's chart), Near Vision, Contrast sensitivity (pelli-robson chart) &Subjective visual satisfaction (by National Eye Institute Visual Functioning Questionnaire 25) were evaluated during each post-op visit.

RESULTS & DISCUSSION

The study was a hospital based randomised control trial with 85 patients, who underwent cataract extraction surgery by phacoemulsification. 42 patients were implanted with multifocal IOL and 43 patients were implanted with monofocal IOL. 3 patients had pre-existing posterior capsular opacification and hence were excluded from the study.2 patients were lost in the follow up and hence were excluded from the study. Thus overall, the study included 80 patients with 40 patients implanted with multifocal IOL and 40 patients implanted with monofocal IOL [8, 11].

There was no significant difference between the two groups in term of age distribution, sex, preoperative distant & near visual acuity.

Comparison of post operative uncorrected distance visual acuity between the two IOL groups (Table1)

At the end of 6 month we found that the distance visual acuity in the multifocal IOL group and monofocal IOL group was 37/40 (92.50%) and 38/40 (95%) respectively. The Fisher exact value is 0.5000 and the p value is 1.0000. Thus there is no significant difference between the two groups in terms of the UCDVA.

Comparison of post operative uncorrected near visual acuity between the two IOL groups (Table 2)

The post operative uncorrected near visual acuity in the multifocal IOL versus monofocal IOL is 75% and 0% respectively for N 6 near vision. The Fisher exact value is 0.0000 and the p value is 0.0000 Thus there is a highly significant difference between the two groups in terms of the uncorrected near visual acuity [5, 8, 11].

Spectacle independence was achieved in 29/40 (72.50%) patient with multifocal IOL while no patient out of the 40 patient with monofocal IOL achieved spectacle independence. P = 0.000 – highly significant [8].

In the multifocal IOL group 10% reported of halos as compared to the monofocal IOL group in which 7.5% reported if halos. The chi square value comes out to be 0.0611 and the p value is 0.8048 (not significant). In the multifocal IOL and monofocal IOL group the complaint of glare was reported by 12.5% and 10% patients respectively. The chi square value comes out to be 0.2128 and the p value is 0.6445 (not significant). Thus there is no significant difference in the multifocal and monofocal IOL group in terms of halos and glare complained by the patients.

At the end of 6 months 39/40 (88.64%) subjects in the monofocal IOL group exhibited a better contrast sensitivity. In the multifocal IOL group at the end of 6 month only 5/40 (11.36%) patient exhibited better contrast sensitivity [9].

Table 1: Comparison of post operative uncorrected distance visual acuity between the two IOL groups

Visual acuity	Multifocal IOL group (N=40)		Monofocal IOL group (N=40)		Fisher exact value = 0.5000 p value = 1.0000
	No. of patients	Percent	No. of patients	Percent	
Less than 6/6	3	7.50%	2	5%	
6/6	37	92.50%	38	95%	

Table 2: Comparison of post operative uncorrected near visual acuity between the two IOL groups

Visual acuity	Multifocal IOL group (N=40)		Monofocal IOL group (N=40)	
	No. of patients	Percent	No. of patients	percent
N 36	0	0%	32	80%
N 18	0	0%	8	20%
N 12	0	0%	0	0%
N 10	3	7.5%	0	0%
N 8	7	17.5%	0	0%
N 6	30	75%	0	0%

CONCLUSION

- The distance vision without glasses was almost similar in both groups [8].
- Near vision without glasses was better in the multifocal group [8].
- Complaints of reduced contrast sensitivity were found in the multifocal IOL group as compared to monofocal IOL group at low contrast levels [9].
- Patients with multifocal IOL implant achieved spectacle independence more often
- There was no significant difference between the multifocal and monofocal IOL groups with respect to complaints of halos and glare.
- Patients overall satisfaction with vision was high and equal across the two groups, revealing that adequate counselling can lead to patient satisfaction regardless of spectacle independence or photic phenomena.

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