

A COMPARATIVE STUDY TO EVALUATE THE VISUAL OUTCOMES (DISTANCE, INTERMEDIATE AND NEAR) OF MULTIFOCAL IOL VS MONOFOCAL IOL IN PATIENTS UNDERGOING CATARACT SURGERY

Saranya Kalaiselvan¹, Meenakshi Babu², Sharmila Devi Vadivelu³, Sivakami M³, Ananda Babu⁴

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Corresponding Author:

Dr. K. Saranya

Email: saranyakalai61@gmail.com

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¹Assistant Surgeon, Department of Ophthalmology, Government Headquarters Hospital, Erode.

²Associate Professor, Department of Ophthalmology, Madurai Medical College, Madurai.

³Associate Professor, Department of Ophthalmology, Thanjavur Medical College, Thanjavur

⁴Assistant Professor, Department of Ophthalmology, Regional Institute of Ophthalmology, Government Ophthalmic Hospital, Madras Medical College, Chennai, India.

⁵Professor, Department of Ophthalmology, ACS Medical College and Hospital, Chennai, India.

Abstract

Background: To evaluate the visual acuity – at distance, intermediate and near to find out the effectiveness of Multifocal IOL vs Monofocal IOL in patients undergoing cataract surgery. **Materials and Methods:** This prospective, comparative study was conducted at cornea and contact lens department, Regional institute of Ophthalmology, Government ophthalmic Hospital, Egmore, Chennai from Jan 2018-Jan 2019. 30 patients (60 eyes) obeying inclusion criteria were registered, evaluated and followed up during the study period. A detailed history of the patient was taken. After preoperative evaluation, phacoemulsification with IOL implantation was done by a single surgeon for all patients. Patients were followed up postoperatively with assessment of distant, intermediate and near visual acuity for a period of 6 months at regular intervals. Distant vision tested with SNELLEN'S distant vision chart, intermediate vision with SLOAN ETDRS intermediate vision chart at distance of 80 cm and Near Vision with SNELLEN'S near vision chart at 35 cm distance. Contrast Sensitivity assessment using mars contrast sensitivity and response to quality of vision questionnaire were evaluated post operatively during follow up period. **Result:** In the multifocal group (n = 30) versus the monofocal group (n =30), significantly more patients achieved uncorrected distance 6/12 or better (63.3% vs 36.7%) and near acuity of N8 and spectacle independence (60 vs 20%; P < .0001) at 6 months. The percentage of patients who achieved uncorrected distance visual acuity of 6/12 or better at 6 months was 74% in the multifocal group and 54% in the monofocal group. National Eye Institute Refractive Error and Quality of Life scores were significantly better in the multifocal group (P < .0001) and other domain scores were similar between both groups. **Conclusion:** Monofocal and multifocal IOLs provided good clinical outcomes with distant vision. More patients receiving multifocal IOLs attained better uncorrected visual acuity at a range of intermediate and near vision and spectacle independence compared with patients who received monofocal IOLs.

INTRODUCTION

Cataract is a common, vision-altering condition,^[1] that affects nearly 4 million people in India. Implantation of a monofocal intraocular lens (IOL) after surgical removal of cataract via phacoemulsification is the standard of care over past.^[2] Although monofocal IOLs result in excellent

distance acuity, patients usually require corrective spectacles for vision at near and intermediate distances and residual astigmatic error, if any.^[3,4] Astigmatism should be managed during cataract surgery and IOL implantation to minimize postoperative dependence on spectacles.^[5] Incomplete restoration of visual acuity in patients implanted with monofocal has been associated with limiting factors contributing to quality of life, such

as reading and maintaining hobbies that require near vision.^[6] Multifocal IOLs could decrease patients need for spectacles by providing good vision across a range of distances (near, intermediate, and far). Newer multifocal IOL designs improve patient vision and achieve acceptable patient satisfaction.^[7]

Aim and Objectives

To evaluate and compare visual outcomes, spectacle independence, and patient vision-related quality of life following bilateral implantation of either monofocal IOLs or multifocal IOLs among patients undergoing cataract surgery.

MATERIALS AND METHODS

Study Design: This was a prospective, randomized, comparative, 6-month follow-up study conducted in cornea department, RIO-GOH, Egmore, Chennai. The study protocol was approved by the ethics committee of The Tamilnadu Dr. MGR medical university. Informed consent was provided by all patients before entering the study.

Patients: Study participants, included patients aged 40 years or older, having bilateral age-related cataracts and planned cataract removal using phacoemulsification with subsequent IOL implantation. Eligible patients were either nonastigmatic or were astigmatic with pre-operative regular corneal astigmatism of 2.5 diopters (D) or less. Key exclusion criteria included previous ocular surgery or trauma, corneal and retinal pathology.

All the patients underwent complete ophthalmological examination which includes measurement of Visual acuity- uncorrected, best corrected distant and near visual acuity using Snellen chart. Slit lamp evaluation of anterior and posterior segment. Nuclear cataract was graded with slit beam at 30–45° angle to the cataract, whereas cortical and posterior subcapsular cataract was graded by retroillumination using the WHO criteria.^[8] Axial length was measured by immersion technique and keratometry was done by autokeratometry. IOL power was calculated by SRK/T formula. Phacoemulsification with 'in the bag' implantation of posterior chamber IOL was performed. All surgeries was done by a single surgeon.^[9,10]

Patients were followed up on day 1, 1st week, 3rd week, 6th week, 3rd month, 6th month with measurement of distant, intermediate and near visual acuity and contrast sensitivity assessment using Mars contrast sensitivity chart.^[11]

RESULTS

This study includes data of 60 eyes of 30 patients in the age group of above 50 years with bilateral implantation of multifocal IOL in 15 patients and monofocal IOL in 15 patients. In our study 56.7% of the patients were male and 43.3% were females.

Post-Operatively,

On Day 1,

Distant vision

Higher proportion of multifocal IOL implanted eyes and monofocal IOL vision 6/9 or better. Hence no significant difference noted between the types of IOL regarding Distant vision. [Table 1]

Of Multifocal IOL implanted patients, 12 patients (24 eyes) had 6/6 vision and 3 patients (6 eyes) had 6/9 vision.

Of Monofocal IOL implanted patients, 9 patients (18 eyes) had 6/6 vision, 1 patient had 6/6 in one eye and 6/9 in other eye and 5 patients (10 eyes) had 6/9 vision.

Intermediate Vision [Table 2]

Of Multifocal IOL implanted patients, 9 patients (18 eyes) had 6/6 vision and 5 patients (6 eyes) had 6/9 vision and 1 patient had 6/9 in one eye and 6/12 in other eye.

Of Monofocal IOL implanted patients, 1 patient (2 eyes) had 6/6 vision, 5 patients (10 eyes) had 6/9 vision and 9 patients (18 eyes) had 6/12 vision.

Near Vision [Table 3]

Higher proportion of multifocal lens implanted eyes were having a vision of N8 or better (9,10), than the monofocal IOL in near vision as shown in [Table 2]

Of Multifocal IOL implanted patients, 12 patients (24 eyes) had N6 vision and 3 patients (6 eyes) had N8 vision.

Of Monofocal IOL implanted patients, 1 patient (2 eyes) had N6 vision, 8 patients (16 eyes) had N8 vision and 6 patients (12 eyes) had N10 vision.

After 1 month post operative period

Distant vision

After 1 month post operative follow up of patients, Multifocal IOL implanted patients, 12 patients (24 eyes) had 6/6 vision and 3 patients (6 eyes) had 6/9 vision.

Of Monofocal IOL implanted patients, 10 patients (20 eyes) had 6/6 vision, 5 patients (10 eyes) had 6/9 vision.

Multifocal IOL patients and monofocal IOL have better distant vision and significant difference noted.

INTERMEDIATE VISION

Of Multifocal IOL implanted patients, 14 patients (28 eyes) had 6/6 vision and 1 patients (2 eyes) had 6/9 vision.

Of Monofocal IOL implanted patients, 1 patient (2 eyes) had 6/6 vision, 5 patients (10 eyes) had 6/9 vision and 9 patients (18 eyes) had 6/12 vision.

Multifocal IOL implanted patients have better intermediate vision compared with monofocal IOL implanted patients.

NEAR VISION

Higher proportion of multifocal lens implanted eyes were having a vision of N8 or better, than the monofocal IOL in near vision as shown in [Table 5].

Of Multifocal IOL implanted patients, 12 patients (24 eyes) had N6 vision and 3 patients (6 eyes) had N8 vision.

Of Monofocal IOL implanted patients , 1 patient(2eyes) had N6 vision, 8 patients(16 eyes) had N8 vision and 6 patients (12 eyes) had N10 vision.

After 1 month post operative period, mean of contrast sensitivity in eyes with monofocal and

multifocal are 1.058 and 1.020 respectively. There was not much difference in contrast sensitivity between the two types of IOL. There was no significant association between the type of IOL and preoperative parameters like IOP, K1, K2 and Axial Length.

Table 1: Association between type of IOL and immediate OP Distant vision

Type of IOL	Immediate post OP Distant vision	
	6/6	6/9
Monofocal	19	11
Multifocal	24	6

Table 2: Association between type of IOL and Immediate Post OP Intermediate Vision

Type of IOL	Immediate Post OP Intermediate Vision		6/12
	6/6	6/9	
Monofocal	2	10	18
Multifocal	18	11	1

Table 3: Association between type of IOL and Immediate Post OP Near Vision

Type of IOL	Immediate Post OP Near Vision		N10
	N6	N8	
Monofocal	2	16	12
Multifocal	24	6	

Table 4: Association between type of IOL and 1 month POST OP Distant vision

Type of IOL	1 month post OP Distant vision	
	6/6	6/9
Monofocal	20	10
Multifocal	24	6

Table 5: Association between type of IOL and 1 month Post OP Intermediate Vision

Type of IOL	1 Month Post OP Intermediate Vision		6/12
	6/6	6/9	
Monofocal	2	10	18
Multifocal	28	2	

Table 6: Association between type of IOL and 1 month Post OP Near Vision

Type of IOL	1 Month Post OP Near Vision		N10
	N6	N8	
Monofocal	2	14	14
Multifocal	28	2	

DISCUSSION

Of the 60 eyes included in our study 30 eyes were implanted with multifocal and 30 eyes with monofocal lenses. Mean age group was 56.43 with SD 7.02. These patients were followed up for a mean period of 6 months.

Majority of the study participants were having a distant vision of 6/9 or better in immediate post-op period. No significant difference noted between the types of IOL regarding Distant vision.

Higher proportion of multifocal IOL implanted patients were having a better intermediate vision. Significant association between type of IOL and postoperative intermediate vision present.

Higher proportion of multifocal lens implanted patients were having a better near vision than monofocal patients. [Table 5].

There was no incidence of post operative complications of cataract surgery in our study.^[13]

There was no significant association between the type of IOL used and preoperative parameters like IOP, K1, K2 and axial length.

Less spectacle dependence with multifocal lenses and no reduction in contrast sensitivity were observed in our study as compared with other studies shown below.^[12-17]

Samantha R de silva et al assess the visual effects of multifocal IOL in comparison with the monofocal IOL in Randomised Controlled Trials and include eligible trials conducted in Europe and North America. Concludes by fact that people with multifocal lenses had similar distance vision and near vision compared with people receiving monofocal lenses but reported less spectacle dependence.^[18-20]

Sen HN et al,^[21] showed that both distance and near visual acuities were significantly better in multifocal group than in monofocal group. 67.3% in multifocal group and 14.9% in monofocal group achieved a better near acuity, 56.6% in multifocal group and

28.4% in monofocal group achieved a best corrected distant visual acuity of 20/20 or better. Halos were slightly more common in multifocal group at 1 month postoperative period.

Steinert RF et al,^[20] a significantly higher proportion of 81% of bilateral multifocal subjects report they could function comfortably at near without the use of spectacles relative to 56% monofocal subjects and 58% unilateral Multifocal subjects.

CONCLUSION

According to the results of our study, there is sufficient evidence to conclude that Multifocal IOL are efficient in improving intermediate and near vision after cataract surgery compared with Monofocal IOL. Patient satisfaction and spectacle independence are better in eyes with Multifocal IOL. Coloured halos and altered contrast sensitivity had not been reported in Multifocal IOL implanted patients.^[19]

Hence Multifocal IOL provide higher subjective satisfaction and can be used in patients undergoing cataract surgery who had desire to be spectacle independent and based on functional and occupational requirements.

Declaration of Patient Consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

REFERENCES

1. Congdon N, Vingerling JR, Klein BE, et al. Prevalence of cataract and pseudophakia/aphakia among adults in the United States. *Arch Ophthalmol.* 2004;122:487-494.
2. Lundstrom M, Barry P, Henry Y, Rosen P, Stenevi U. Evidence based guidelines for cataract surgery: guidelines based on data in the European Registry of Quality Outcomes for Cataract and Refractive Surgery database. *J Cataract Refract Surg.*2012;38:1086-1093.
3. Calladine D, Evans JR, Shah S, Leyland M. Multifocal versus monofocal intraocular lenses after cataract extraction. *Cochrane Database Syst Rev.* 2012;9:CD003169.
4. Maxwell WA, Waycaster CR, D'Souza AO, Meissner BL, Hileman K. A United States cost-benefit comparison of an apodized, diffractive, presbyopia-correcting, multifocal intraocular lens and a conventional monofocal lens. *J Cataract Refract Surg.*2008;34:1855-1861.
5. Rubenstein JB, Raciti M. Approaches to corneal astigmatism in cataract surgery. *Curr Opin Ophthalmol.* 2013;24:30-34.
6. Alio JL, Plaza-Puche AB, Pinero DP, Amparo F, RodriguezPratz JL, Avala MJ. Quality of life evaluation after

- implantation of 2 multifocal intraocular lens models and a monofocal model. *J Cataract Refract Surg.* 2011;37:638-648.
7. de Vries NE, Laurendeau C, Lafuma A, Berdeaux G, Nuijts RM. Lifetime costs and effectiveness of ReSTOR compared with a monofocal IOL and Array-SA40 in the Netherlands. *Eye (Lond).*
8. Thylefors B, Chylack LT Jr., Konyama K, Sasaki K, Sperduto R, Taylor HR, et al. A simplified cataract grading system. *Ophthalmic Epidemiol* 2002;9:83-95.
9. Tomofusa Yamauchi, Hitoshi Tabuchi, Kosuke Takase, Hideharuohsugi, Zaigen Ohara, Yoshiaki Kiuchi Compare the visual performance of multifocal intraocular lenses(IOLs) and monofocal IOLs of the same material-vol 8(6),jun 28,2013,doi:10.1371/journal.pone.0068236.
10. Zequan Xu, Wen Zhe Li, Lianqun Wu, Shuang Xue, Xuchen and Qiang Wu comparison of the clinical performance of Refractive Rotationally Asymmetric Multifocal IOLs with Other Types of IOLs: A Meta analysis vol, july 2018,Journal of Ophthalmology.
11. williamsonw, porier L, couplon Compared optical performance of multifocal and monofocal intraocular lenses(contrast sensitivity and dynamic visual acuity) vol 78 1994;British journal of ophthalmology.
12. Sunil Shah, Cristinaaperis – Martinez, Thomas Reinhard, Paolo Vinciguera visual outcome after cataract surgery: Multifocal versus Monofocal intraocular lenses ,vol 31(10) 2015,Journal of cataract and refractive surgery.
13. Liberdade C Salerno, Mauro C Tiveron, Jorge L Alio Multifocal intraocular lenses: Types, outcomes, complications and how to solve them,vol 7,2017,Taiwan Journal of Ophthalmology.
14. Maghraby A Marzoukya, Gazayerli E, Karr M, Deluca M. Multifocal versus monofocal intraocular lenses.visual and refractive comparison,vol 18(2),1992,journal of cataract and refractive surgery.
15. MGT Dolders, M D Nijkamp, R M M A Nuijts,B Van de Borne, F Hendrikse, A Ament, W Groot. Cost effectiveness of foldable multifocal intraocular lenses compared to foldable monocular lenses,vol 88,British Journal of Ophthalmology.
16. Pieh S Lackner B, Hanselmayer G, Zohner R, Sticker M. Halo size under distance and near conditions in refractive multifocal intraocular lenses,vol 85,2001,British journal of ophthalmology.
17. E. Rosen, J. L. Alio, H,B, Dick, S. dell and S,Slade,Efficacy and safety of multifocal intraocular lenses following cataract and refractive lens exchange,vol42(2),2016,Journal of cataract and refractive surgery.
18. Agnieszka Dyrda, Ana Martinez-palmer, DANIEL martin moral, Amandarey, AntonioMorilla ,Miguel Castilla-Marti and Janny Aronessantivanecz. Clinical results of diffractive, refractive, hybrid multifocal and monofocal intraocular lenses , vol 2018,Journal of Ophthalmology.
19. Salvatore cilino, Giovannicilino, simona, dinaro, aissaigui, Viviana Firpo, Girolamo Maniscalco, Alessandracasucco. Objective electrophysiological contrast sensitivity with monofocal and multifocal intraocular lenses,vol 3(4),2018,Annals of eye science.
20. Steinert RF, Post CT, Brint SF, Fritch CD, Hall DL, Wilder LW, et al. A prospective, randomized, double-masked comparison of a zonal-progressive multifocal intraocular lens and monofocal intraocular lens. *Ophthalmology* 1992;99(6):853-61.
21. Sen HN, Sarikkola AU, Uusitalo RJ, Laatikainen L. Quality of vision after AMO Array multifocal intraocular lens implantation. *Journal of Cataract and Refractive Surgery* 2004;30(12):2483-93.