Original Article

Lucidis 124m Edof IOL; Experience from Two Tertiary Care Centers and Quality of Life Study

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ABSTRACT

Purpose: To determine visual outcomes and post-operative complications after Lucidis 124M EDOF IOL implantation after phacoemulsification and to see the effect of these lenses on Quality of life of the patients.

Study Design: Mixed study design **(**Quasi Experimental and qualitative analysis).

Place and Duration of Study: WAPDA Teaching Hospital and Acuity Eye Centre, Lahore, from November 2017 to October 2022.

Methods: Hundred eyes of seventy five patients underwent Lucidis EDOF IOL implantation after phacoemulsification using 2.75 mm clear posterior corneal incisions. Criteria used to document visual outcomes were uncorrected and corrected distance and near vision measurements. Quality of life (QoL) was assessed by interviewing the patients at least 6 months postoperatively using google forms.

Results: Hundred eyes of 75 patients were enrolled. There were 39 (52%) males and 36 (48%) females. Mean age was 1.48 ± 0.50 years. Mean baseline un-corrected visual acuity (UCVA) was 2.83 ± 1.48. Eighty two percent eyes had corrected vision of 6/6 and 75 eyes achieved N.6 for near. Fifty patients out of 75 responded to the questionnaire regarding QoL. Sixteen percent patients had glare, 85% reported no difficulties during night driving and 68% had no problem in watching TV without glasses. Sixty eight percent did not experience any itching, watering, or discomfort and 90% responded that their QoL had improved. None of the patients had lens deposits, discoloration or decentration. One had endophthalmitis.

Conclusion: Lucidis EDOF IOL are safe and effective lenses in terms of visual outcomes and spectacle independence resulting in better quality of life.

Key Words:

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INTRODUCTION

Patients with cataracts often encounter various visual impairments, including reduced visual acuity (VA), diminished contrast sensitivity, difficulties in handling glare, and altered colour perception. These visual deficits can result in practical challenges in daily life. Over time, cataract surgeries and intraocular lenses (IOLs) have undergone significant advancements in technology. Premium IOLs such as toric and multifocal IOLs, have revolutionized the outcomes of cataract surgeries by substantially reducing patients' reliance on eyeglasses. Toric IOLs are designed to correct astigmatism, which results in distorted vision. Multifocal IOLs, on the other hand, offer patients the ability to focus at different distances, enabling clear vision for both near and far. In contrast, monofocal IOLs are primarily aimed at providing clear distance vision, and patients may still require glasses for near vision tasks. Spectacle correction is often necessary when using monofocal IOLs to address near vision needs. The premium IOLs have provided patients with more options and improved visual outcomes following cataract surgery, enhancing their overall quality of life. The option of monovision i.e. with dominant eye

focused at near and other eye at far is yet another possibility with monofocal IOLs. However, this may cause a loss of depth perception leading to a compromise in the ultimate binocular visual outcome.[1]

Multifocal IOL (MFIOLs) provide varying focusing powers for near and intermediate vision, but they are frequently linked to dysphotopsia, such as halos, glare, and reduced contrast sensitivity. As a result, refractive MFIOLs are no longer commonly used in clinical practice because of serious postoperative concerns and limitations in terms of pupil dependency. Diffractive MFIOLs provide presbyopic and hyperopic patients with a high rate of spectacle independence while minimizing negative effects.[2] Bifocal diffractive MFIOLs improve far and near vision while diffractive trifocal MFIOLs improve far, intermediate and near vision as well. Despite recent refinements, diffractive technology has failed in reducing halos and glare especially during night driving. Visual disturbances at night, light sensitivity, glare, and difficulty with intermediate vision (computer work) are some of the negative effects of multifocal IOL implantation.[2] One of the most serious disabling problem is postoperative astigmatism. It is the most common reason for use of spectacles and has been addressed by introduction of toric IOLs.

Lucidis is a high technology refractive EDOF MFIOL designed to improve vision after cataract surgery.[3] It improves quality of vision of a person with an excellent balance of far and near range with high-quality optical design having an aspheric optical center surrounded by a refractive outer surface. Closed loop haptic design provides a best fit of the lens in the capsular bag.[4] Additional benefit given by Lucidis is the range of clear vision from near to intermediate providing an extra level of visual comfort.

EDOF IOLs are claimed to give good vision for near and computer vision without help of any glasses and have a lower chance of glare and halos at night.[5] Lucidis is an easily manageable single-piece foldable IOL with an optical diameter of 6.0 mm, designed using pseudo non-diffracting beam technology. It is regarded as a viable option when compared to existing presbyopia correcting IOLs. Lucidis operates on the principle of generating a single elongated focal point, which leads to an expanded range of vision.[3]

This study aims to look at intraoperative behaviour, vision improvement, postoperative complications and quality of life of patients with EDOF IOL at two tertiary care centers of Lahore, Pakistan.

METHODS

This study was conducted at WAPDA Teaching Hospital and Acuity Eye Centre, Lahore. It involved 100 eyes of 75 patients diagnosed with uncomplicated cataract and no other coexisting ocular conditions. The patients were selected using a non-probability sampling technique. The study was conducted from November 2017 to October 2022. Lucidis EDOF IOLs were implanted after phacoemulsification. All participants were between 40 to 80 years of age. Routine pre-operative evaluation and biometry were performed using Auto-Keratometer and Ultrasonic Biometer. All the patients were operated by the same surgeon using 2.75 mm clear posterior corneal incisions placed temporally. Patients with intraoperative anterior and posterior capsular rips were excluded from the study. Postoperative assessments were conducted on the 1st day, 1st week, 1st month, 6th month, and annually thereafter. The criteria used to document visual outcomes were uncorrected and corrected distance and near vision measurements. The complications were also documented at each visit, especially, posterior capsular opacity (PCO), lens decentration, deposits and discoloration were critically evaluated and noted. Quality of life (QoL) was assessed by interviewing the patients at least 6 months postoperatively using google forms and was analysed by google forms. Data was analyzed using SPSS version 26.

RESULTS

100eyes of 75 patients were enrolled in the study fulfilling the inclusion criteria. Participants were examined preoperatively and on the 1st day, 1st week, 1st month, 6th month and yearly thereafter post-operatively. Out of 75 enrolled patients, 39 (52%) were male and 36 (48%) were females. Mean age was 1.48 ± 0.50 years. Descriptive analysis was performed for demographic profile and clinical outcomes (Table 1). Friedman's Two-Way analysis was performed to compare follow ups ($P<0.05$).

These results demonstrated significant improvement in near vision after correction, highlighting the success of intervention in addressing both distance and near vision needs for the patients.

Table 1: *Post-operative Visual Outcomes at 6th month.*

	Distance Visual acuity			Near Visual acuity	
	Participants with Un-Corrected Visual Acuity (UCVA)%	Participants with Best-Corrected Visual Acuity (BCVA) %		Participants with Un-Corrected Visual Acuity (UCVA) %	Participants with Best-Corrected Visual Acuity (BCVA) %
6/24	1 (1%)	1 (1%)	N.14	1 (1%)	0 (0%)
6/18	6 (6%)	1 (1%)	N.12	4 (4%)	0 (0%)
6/12	9 (9%)	5 (5%)	N.10	7 (7%)	7 (7%)
6/9	31 (31%)	11 (11%)	N.8	27 (27%)	18 (18%)
6/6	53 (53%)	82 (82%)	N.6	61 (61%)	75 (75%)
Mean±SD	6.29 ± 0.935	6.72 ± 0.697		7.14 ± 1.735	6.64 ± 1.202

Table 2: *Survey for QoL (Quality of life).*

No.	Question	Yes (%)	No (%)	Not Sure (%)
1.	Feeling extra images, glare or confusion	8(16%)	37(74%)	5(10%)
2.	Difficulty while driving (Only 20/50 patients were driving)	2(10%)	17(85%)	1(5%)
3.	Can watch TV/nature without glasses	34(68%)	15(30%)	1(2%)
4.	Use of glasses while using mobile, PC/Laptop	14(28%)	36(72%)	0(0%)
5.	Feel any problem like itching, watering, discomfort etc.	16(32%)	34(68%)	0(0%)
6.	QoL and vision became better after surgery	45(90%)	4(8%)	1(2%)

The correction has led to better visual acuity at both near and distance.

50 patients out of 75 responded to the questionnaire regarding various visual symptoms and the perceived improvement in vision and QoL after surgery. Table 2 shows response of the participants regarding QoL.

The follow up visits were continued after 6 months on a yearly basis for 3 years to check for any kind of complications. Out of 100 eyes of 75 patients in 3 years, 17 came up with complaints of blurred vision and were diagnosed with posterior capsular opacification for which they underwent YAG capsulotomy. None had lens deposits, discoloration or decentration of IOL. One patient came up with endophthalmitis. Intravitreal injections Vancomycin, Fortum and Dexamethasone were administered twice 72 hours apart. The patient needed YAG membranectomy later and recovered 6/18 vision in that eye. This patient was a data entry computer operator by profession and he is still comfortable at far, near and computer distances without glasses in both eyes.

DISCUSSION

EDOF technology is widely considered as one of the most effective methods proposed to enhance independence from glasses following cataract surgery. It offers patients the potential to achieve clear vision at various distances without the need for corrective eyewear.[5] MFIOLs have demonstrated superior near vision capabilities compared to EDOF lenses. They provide patients with the ability to see clearly at both near and far distances, offering a wider range of visual acuity. However, one drawback associated with MFIOLs is the halos, glare, and starbursts around light sources. On the other hand, EDOF lenses, despite being less effective for near vision, offer several advantages. They provide an extended range of focus, enabling patients to have good vision at intermediate and far distances. This makes EDOF lenses well-suited for activities such as driving, watching television, or engaging in outdoor pursuits.[6] Moreover, EDOF lenses typically exhibit fewer visual disturbances compared to MFIOLs, leading to enhanced overall visual quality.

A study on trifocal lenses revealed that more than 90% of patients were satisfied with the outcome. Spectacle independence at all distances was higher than 90%.[7] Consequently, the near vision capability of EDOF IOLs falls somewhere between that of monofocal and trifocal IOLs. EDOF IOLs and trifocal IOLs tend to perform similarly in terms of distance and intermediate vision.[8] At three-month follow-up after surgery, Ramamurthy et al. reported spectacle independence of at least 94.0% across all distances.[9] Our findings revealed that 84% of patients have good vision at far and 68% at near after implantation of EDOF IOLs (Range: 7.14 ± 1.735 D). Our outcomes revealed that for far vision Lucidis EDOF lenses have comparable results to trifocals but did not achieve

similar outcomes for near vision.

In our study, UCVA of patients from 6/6 to 6/9 was 84%. The level of spectacle independence can vary based on individual habits and lifestyle, making it a subjective measure. While EDOF IOLs may not be as efficient for near vision compared to other options, it is noteworthy that studies have reported no complaints regarding the occurrence of halos. Additionally, patients have demonstrated the ability to adapt and increase their tolerance towards photic phenomena in the months following the surgery.[10]

Dysphotopsia refers to unusual visual phenomena, such as glare, halos, and other disturbances, experienced by patients following IOL implantation during cataract surgery. Positive dysphotopsia is receiving an extra image and includes symptoms like glare, light streaks, starbursts, arcs, rings, and haloes, which can be attributed to factors such as the IOL's high refractive index and reflectance, as well as backscatter from the lens and microsaccades. On the other hand, negative dysphotopsia is absence of vision in any part of visual field and presents as an arc-shaped shadow or line in the temporal visual field, resembling a temporal scotoma.[11] Glare, halos, and other visual disturbances are frequently reported by individuals who have undergone implantation of MFIOLs. In fact, MFIOLs account for approximately 31% of all cases where IOLs have been removed.[12] Although number of patients was limited in our study but we did not have to remove or exchange any of the Lucidis IOL. Patients who undergo IOL implantation during cataract surgery are also more likely to experience issues like glare and have a higher likelihood of requiring IOL replacement within the first year after surgery.

MFIOL recipients are more likely to achieve spectacle independence compared to those who undergo EDOF IOL implantation.[13] Considerable proportion of patients reported experiencing vision problems six months following MFIOL implantation, according to a comparative study of three distinct types of MFIOLs.[13] In particular, haloes were reported by 65% to 79% of patients, and glare was recorded by 43% to 64%. These results underline how crucial it is to take into account potential visual side effects while choosing MFIOLs for cataract surgery patients.[14] These symptoms can affect the quality of vision and potentially impact a person's QoL. In comparison, our study outcomes revealed that 16% of individuals reported experiencing dysphotopsia. Lesser incidence of significant dysphotopsia in our study as compared to diffractive MFIOLs is in agreement with most of the studies reported internationally.[15,16,17] Though 16% patients reported dysphotopsia but it was not significant enough to hamper their lifestyles and all of them were able to adjust and adapt to it over time.

Postop complications following cataract surgery were generally infrequent, and many studies did not consistently incorporate complications in their outcome evaluations. However, a specific study indicated that trifocal IOLs resulted in a higher incidence of PCO compared to EDOF IOLs at the 12-month postoperative mark.[18] In another study, it was found that three years after cataract surgery, occurrence of Nd:YAG capsulotomy was 5% for Alcon AcrySof IOL, whereas for other IOLs, the incidence ranged from 21.2% to 31.1% ($p < 0.0001$ for each comparison).[19] Our study revealed that 17% of patients came up with complaints of blurred vision and had PCO.

It is also important to note that some of the so-called EDOF lenses available today are really MFIOL with low near add power, in which part of the rest of the power has been withdrawn to avoid the overlapping of images.[20]

Limitations of the study are limited sample and non-comparative study design. Further research can compare different IOLs in terms of QoL.

CONCLUSION

The Lucidis EDOF technology for IOL emerges as a secure, cost-effective, and successful choice for the patients wanting less spectacle dependence after cataract surgery. Visual outcomes and spectacle independence for far are comparable to other IOL implantations whereas less spectacle dependence is significantly better than monofocal IOLs but lesser than diffractive trifocal IOLs. EDOF technology appears to minimize the risk of dysphotopsias. The compatible or preloaded IOL injection system is the need of hour to save intraoperative manipulation and safe surgeon friendly implantation of the IOL.

Conflict of Interest: Authors declared no conflict of interest.

Ethical Approval: The study was approved by the Institutional review board/Ethical review board **(OSP-IRB/009-2023).**

REFERENCES

1. **Tomagova N, Elahi S, Vandekerckhove K.** Clinical Outcomes of a New Non-Diffractive Extended Depth-of-Focus Intraocular Lens Targeted for Mini-Monovision. Clin Ophthalmol. 2023:981-990. Doi: 10.2147/OPTH.S405267
2. **Cheng AM, Yin HY, Davenport C, Walter K.** Clinical outcome of diffractive multifocal lens versus monofocal lens in post-laser in situ keratomileusis patients: A retrospective, comparative study. Indian J Ophthalmol. 2023;**71(3):**779. Doi: 10.4103/ijo.IJO_1759_22
3. **Pedrotti E, Bonacci E, Kilian R, Pagnacco C, Anastasi M, Ventura M, et al.** Quality of vision and outcomes after bilateral implantation of pseudo-non diffracting beam IOL. Frontiers in Medicine. 2023;**10:**1085280. Doi: 10.3389/fmed.2023.1085280
4. **Wang K, Xia Y, Wang X, Pu Y, Zhao Y, Chang P, et al.** Influence of design parameters and capsulorhexis on intraocular lens stabilities: A 3D finite element analysis. Comput Biol Med. 2023;**160:**106972. Doi: 10.1016/j.compbiomed.2023.106972
5. **Gawęcki M, Prądzyńska N, Kiciński K, Ratajczak A, Karska-Basta I, Grzybowski A.** Patient reported outcomes after implementation of an enhanced depth of focus intraocular lens with low postoperative myopia. AdvOphthalmolPract Res. 2023;**3(2):**86-92. Doi: 10.1016/j.aopr.2023.02.003.
6. **Scheepers MA, Hall B.** Randomized and double-blind comparison of clinical visual outcomes of 2 EDOF intraocular lenses. J Cataract Refract Surg. 2023;**49(4):**354-359. Doi: 10.1097/j.jcrs.0000000000001113.
7. **Patel I, Munoz B, Burke AG, Kayongoya A, McHiwa W, Schwarzwalder AW, et al.** Impact of presbyopia on quality of life in a rural African setting. Ophthalmology. 2006;**113(5):**728-734. Doi: 10.1016/j.ophtha.2006.01.028.
8. **Kim TI, Chung TY, Kim MJ, Lee K, Hyon JY.** Visual outcomes and safety after bilateral implantation of a trifocal presbyopia correcting intraocular lens in a Korean population: a prospective single-arm study. BMC Ophthalmol. 2020;**20(1):**288. Doi: 10.1186/s12886-020-01549-z.
9. **Ramamurthy D, Vasavada A, Padmanabhan P, Reddy JC, Shetty N, Dey A, et al.** Clinical Outcomes After Bilateral Implantation of a Trifocal Presbyopia-Correcting Intraocular Lens in an Indian Population. Clin Ophthalmol. 2021;**15:**213-225. Doi: 10.2147/OPTH.S279001.
10. **Cochener B, Boutillier G, Lamard M, Auberger-Zagnoli C.**A Comparative Evaluation of a New Generation of Diffractive Trifocal and Extended Depth of Focus Intraocular Lenses. J Refract Surg. 2018;**34(8):**507-514. Doi: 10.3928/1081597X-20180530-02.
11. **Davison JA.** Positive and negative dysphotopsia in patients with acrylic intraocular lenses. J Cataract Refract Surg. 2000;**26(9):**1346-1355. Doi: 10.1016/s0886-3350(00)00611-8.
12. **de Silva SR, Evans JR, Kirthi V, Ziaei M, Leyland M.** Multifocal versus monofocal intraocular lenses after cataract extraction. Cochrane Database Syst Rev. 2016;**12(12):**CD003169. Doi: 10.1002/14651858.CD003169.pub4.
13. **Serdiuk V, Ustymenko S, Fokina S, Ivantsov I.** Comparison of three different presbyopia-correcting intraocular lenses. Rom. J. Ophthalmol. 2020;64:364–379. Doi: 10.22336/rjo.2020.58
14. **de Vries NE, Webers CA, Touwslager WR, Bauer NJ, de Brabander J, Berendschot TT, et al.** Dissatisfaction after implantation of multifocal intraocular lenses. J Cataract Refract Surg. 2011;**37:**859–865. Doi: 10.1016/j.jcrs.2010.11.032
15. **Kamiya K, Hayashi K, Shimizu K, Negishi K, Sato M, Bissen-Miyajima H.** Survey Working Group of the Japanese Society of C, Refractive S. Multifocal intraocular lens explantation: a case series of 50 eyes. Am J Ophthalmol2014;**158:**215–220 e211. Doi: 10.1016/j.ajo.2014.04.010
16. **Davies EC, Pineda R 2nd.** Intraocular lens exchange surgery at a tertiary referral center: Indications, complications, and visual outcomes. J Cataract Refract Surg. 2016;**42(9):**1262-1267. Doi: 10.1016/j.jcrs.2016.06.031.
17. **Ruiz-Mesa R, Abengózar-Vela A, Aramburu A, Ruiz-Santos M.** Comparison of visual outcomes after bilateral implantation of extended range of vision and trifocal intraocular lenses. Eur J Ophthalmol. 2017;**27(4):**460-465. Doi: 10.5301/ejo.5000935.
18. **Belda JI, Dabán JP, Elvira JC, O'Boyle D, Puig X, Pérez-Vives C, et al.** Nd:YAG capsulotomy incidence associated with five different single-piece monofocal intraocular lenses: a 3-year Spanish real-world evidence study of 8293 eyes. Eye (Lond). 2022**;36(11):**2205-2210. Doi: 10.1038/s41433-021-01828-z.
19. **Gu X, Chen X, Jin G, Wang L, Zhang E, Wang W, et al.** Early-Onset Posterior Capsule Opacification: Incidence, Severity, and Risk Factors. Ophthalmol Ther. 2022**;11(1):**113-123. Doi: 10.1007/s40123-021-00408
20. **Kanclerz P, Toto F, Grzybowski A, Alio JL**. Extended Depth-of-Field Intraocular Lenses: An Update. Asia Pac J Ophthalmol (Phila). 2020;9(3):194-202. Doi: 10.1097/APO.0000000000000296.

Authors' Designation and Contribution

Zia-ul-Mazhry; Head of Department: *Concepts, Design, Literature Search, Manuscript Preparation, Manuscript Editing, Manuscript Review.*

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