

Original Articles

"A Study to Evaluate the Visual Outcomes of Bilateral Implantation of the Diffractive Multifocal Intraocular Lenses in Patients with Cataract."

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ABSTRACT

Background : To evaluate the visual outcomes of bilateral implantation of the diffractive multifocal intraocular lenses in patients with cataract.

Methods : This was a prospective observational study done on 200 eyes of 100 patients to evaluate the visual functions, spherical equivalent & subjective response of patients after bilateral implantation of diffractive multifocal IOL. Patients who wanted to be independent from spectacle use, following uncomplicated phacoemulsification cataract surgery were included in our study. The patients' expectation regarding spectacle independence and visual quality was assessed. Pre-operative examination like visual acuity for distance and near had been taken, subjective refraction and IOP was taken. IOL power was calculated with the help of IOL MASTER 700. Calculation of IOL power was done by optical biometry and SRK-T formula. Post operatively subjective refraction and distance and near visual acuity had been taken in all patients at 3 follow-ups after Cataract Surgery.

Results : A total of 200 eyes of 100 patients who underwent Phacoemulsification with Diffractive Multifocal IOL implantation for cataract surgery. There were 69 females and 31 males aged between 40 to 80 years. In our studies, 100% of patients have uncorrected distance visual acuity- 6/9 or better and 100% have uncorrected near visual acuity of N6 which is statistically significant (p value < 0.0000001). While Post-operative spherical equivalent was observed after 3 month of cataract surgery, there was marked improvement in spherical equivalent after surgery which was statistically significant having P value (0.002151), spherical equivalent ranges from ± 1.25 to $>95\%$ eyes had spherical equivalent less than or equal to $\pm 0.5D$. 100% has spherical equivalent less than or equal to $\pm 1.25 D$. Questionnaire of Patient's visual responses were recorded for near and distance, 95% of patients reported were highly satisfied and 98% of patients were independent of spectacle for near work while 100% of patients were independent of spectacle for Distance work. Finally, 97% patient was satisfied with their cataract surgery.

Conclusion : Cataract surgery with bilateral implantation of apodised diffractive multifocal IOL have improved quality of life in active patients who wish to reduce their dependence on glasses for good distance and near visual acuity. Therefore, by using multifocal IOL, patient becomes spectacle independence in majority of cases. The quality of life questionnaire confirm that patient underwent cataract surgery with multifocal IOL have high level of satisfaction. However, patients have more glare and haloes as compared to traditional Monofocal IOL.

INTRODUCTION

The crystalline lens is the part of the optical system of the eye that focuses rays of the light on the retina. At the age of approximately 40 years most people are losing their ability to accommodate for reading, they become presbyopic. Apart from this, age related changes in the crystalline lens lead to cataract formation. Cataract surgery with an intraocular lens (IOL) has the potential to improve a patient's acuity and refine the refractive error to

a given target. Cataract surgery with implantation of a traditional Monofocal IOL, targeting distant vision leaves most individuals dependent on some correction usually spectacles for near vision.

Currently, the goal of cataract surgery is to provide fast and complete visual rehabilitation without surgical complications with minimal postoperative refractive errors. Several methods and materials used to compensate for loss of accommodation from implantation

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of an intraocular lens (IOL) including multifocal IOL, accommodating IOLs and monovision.

Two types of multifocal IOLs are currently present in market: Refractive Multifocal IOLs and diffractive Multifocal IOLs. The optical function of refractive Multifocal IOL derives from refractive zones for distance and near vision allocated concentrically over optic lens. The working principle of the full optic diffractive multifocal IOLs based on creation of two focal points by using diffraction orders (order 0 & 1). The power corresponding to the 0-order diffraction is used to image distant objects whereas power corresponding to 1- order is used for near vision.

IOL design: IOL is a single piece diffractive multifocal IOL made of hydrophilic acrylic with a hydrophobic surface specifically designed for implantation in the capsular bag. It is an aspheric refractive IOL with an adding power of +3.75D in the lens plane. Its multifocality is due to the presence of concentric rings of different refractive indices.

The current study was conducted to evaluate the visual, refractive, reading performance and patient satisfaction outcomes with this new diffractive aspheric apodized multifocal intraocular lens MFIOL and confirm the benefits of the same in patients after multifocal IOL implantation.

MATERIAL AND METHODS

This was a prospective observational study done on 200 eyes of 100 patients to evaluate the visual functions, spherical equivalent & subjective response of patients after bilateral implantation of diffractive multifocal IOL. The patients of age group between 45 to 75 years having no gender preference with corneal astigmatism of <1.0D were included. Patients who wanted to be independent from spectacle use, following uncomplicated phacoemulsification cataract surgery were included in our study. While patients having pre-existing ocular pathologies like corneal diseases, diabetic retinopathy, ARMD, glaucoma, uveitis, amblyopia etc. & occupational night drivers & pilots were excluded from our study. Even Individuals with monofocal lens in one eye or history of any previous refractive surgery were also excluded. The patients' expectation regarding spectacle independence and visual quality was assessed. During the pre-operative examination, visual acuity for distance as well as for near had been taken using a Snellen's chart, subjective refraction of the patient had been done, IOP was taken by Goldman Applanation Tonometer (GAT) and IOL power was calculated with the help of IOL MASTER 700. Calculation of IOL power was done by optical biometry and SRK-T formula. We had chosen the IOL that result in emmetropic or the nearest negative refraction. Antibiotics

drops were prescribed two days prior to the surgery. All cataract surgery was performed by one surgeon. The procedure consists of phacoemulsification through a 2.8mm incision without sutures, with in the bag implantation of IOL. There should not be any complications. Post operatively patients will be prescribe moxifloxacin Eye drops (4times a day for 10 days), moxifloxacin with dexamethasone 0.1 % Eye drops with decreasing dosage, nepafenac 0.1 % Eye drops 3 times a day for 1 month and CMC eye drops 4 times a day for 1 month. Post operatively subjective refraction and distance and near visual acuity had been taken in all patients at 7th day, 1 month and 3 months after Cataract Surgery. Subjective responses were also recorded in each patient. All the data had been preserved for future references.

STATISTICAL ANALYSIS

The statistical analysis was performed with SPSS 7.0 software and Microsoft Office Excel 7.0.

The average value and standard deviations were calculated for every parameter during followup. Nonparametric statistical paired t test was applied to assess the significance of difference between pre-operative and post-operative data; usually in all cases, the same level of significance ($p < 0.05$) was found.

RESULTS

A total of 200 eyes of 100 patients who underwent Phacoemulsification with Diffractive Multifocal IOL implantation out of which 3 patients were operated for refractive lens extraction and others for cataract surgery. There were 69 females and 31 males aged between 40 to 80 years. Majority of the patients were between 50-59 years hence relatively majority of young population wants to achieve spectacle independence after surgery for daily activities. The female predominance (69%) which was due to the cosmetic appearance and ease of daily activities in household work playing a major factor for diffractive multifocal IOL implantation helping them in daily spectacle free activities.

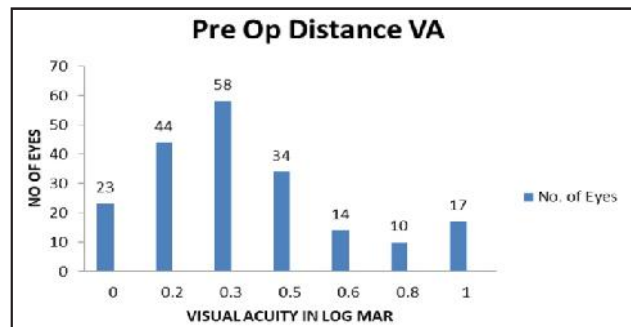


Chart 1 Pre-Operative Distance visual acuity in LOG MAR.

The above chart shows pre-operative distant visual acuity in LOG MAR.

Out of 200 eyes, 23 eyes have visual acuity of 0(6/6), 44 eyes have visual acuity of 0.2(6/9), 58 eyes have visual acuity of 0.3(6/12), 34 eyes have visual acuity of 0.5(6/18), 14 eyes have visual acuity of 0.6(6/24), 10 eyes have visual acuity of 0.8(6/36) while 17 eyes have visual acuity of 1(6/60).

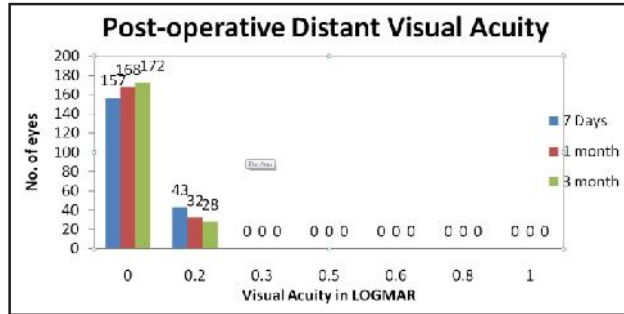


Chart 2 Post-Operative Distance visual acuity in LOG MAR.

The chart 2 shows post-operative distant visual acuity on postoperative day- 1, 1st month and 3month.

There was statistical significant improvement at 7th postoperative day in uncorrected distance visual acuity UCDVA ($p < 0.0000001$) was found.

No significant change in this parameter was detected between 1 and 3 months after surgery.

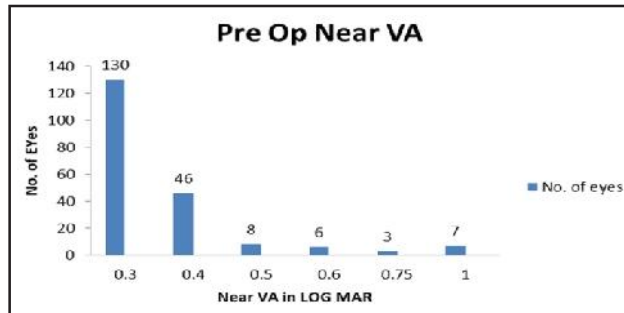


Chart 3 Pre-operative near VA in LOG MAR.

Out of 200 eyes, 130 eyes have visual acuity of 0.3(N6), 46 eyes have visual acuity of 0.4(N8), 8 eyes have visual acuity of 0.5(N10), 6 eyes have visual acuity of 0.6(N12), 3 eyes have visual acuity of 0.75(N18) while 7 eyes have visual acuity of 1(N36).

At 7th day after surgery, a statistically significant improvement was observed in uncorrected near visual acuity(UCNVA). P value < 0.0000001 .

No significant changes in these parameters were observed in the remaining follow up periods.

In our studies, 100% of patients have uncorrected distance visual acuity-6/9 or better and 100% have

uncorrected near visual acuity of N6 which is statistically significant (p value < 0.0000001).

In the study done by Tae-im Kim et al 1 and Lucas Monferrari et al 3 similar uncorrected distance and near visual acuity was obtained i.e. 6/9 or better and N8 or better.

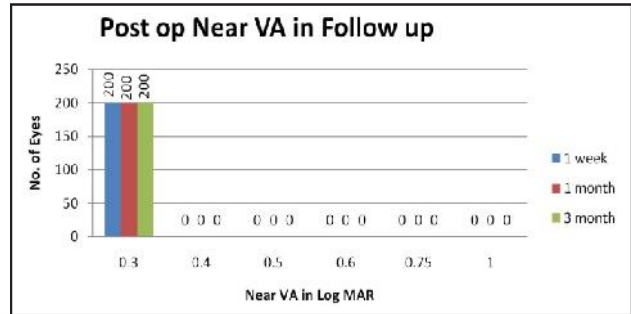


Chart 4 : Post-operative Near visual acuity in LOG MAR.

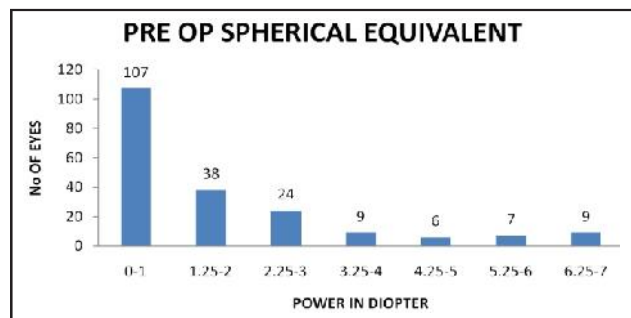


Chart 5 : Pre-operative spherical equivalent in Diopters.

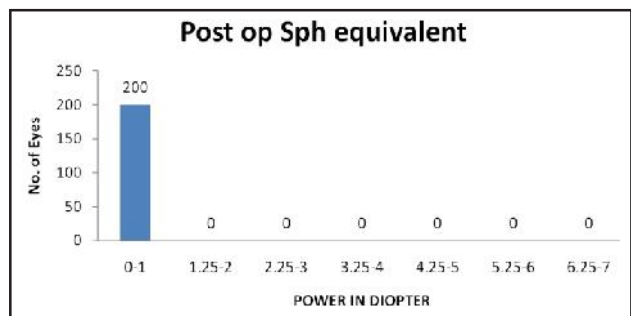


Chart 6 : Post-operative spherical equivalent in Diopters.

It was observed that 3 months after cataract surgery there was marked improvement in spherical equivalent after surgery which was statistically significant having P value(0.002151), spherical equivalent ranges from - 1.25 to +1.25 >95% eyes had spherical equivalent less than or equal to $\pm 0.5D$. 100% has spherical equivalent less than or equal to $\pm 1.25 D$. Similar findings were observed in Jerome C Vryghemet al2studies.

It shows >95% of patients were satisfied with the distance and near visual acuity while only 2% had difficulty in near vision for very small print. 27% patients had complained of

Result of Quality of Life Questionnaire :

Questions	Response	Reply
How satisfied are you with your vision for seeing objects at near distance?	Dissatisfied/very dissatisfied Neither satisfied nor dissatisfied Satisfied /very satisfied	2 2 96
How often do you wear glasses or contact lenses for seeing objects at near distance?	None of the time Some of the time Most of the time All of the time	98 2 0 0
How satisfied are you with your vision for seeing objects at intermediate distance?	Dissatisfied/very dissatisfied Neither satisfied nor dissatisfied Satisfied /very satisfied	1 5 94
How often do you wear glasses or contact lenses for seeing objects at intermediate distance?	None of the time Some of the time Most of the time All of the time	100 0 0 0
How satisfied are you with your vision for seeing objects at distance?	Dissatisfied/very dissatisfied Neither satisfied nor dissatisfied Satisfied /very satisfied	2 2 96
How often do you wear glasses or contact lenses for seeing objects at distance?	None of the time Some of the time Most of the time All of the time	100 0 0 0
How often do you experience halos?	None of the time Some of the time Most of the time All of the time	70 27 2 1
How severe were these halos?	None Mild Moderate Severe	74 24 2 0
If you currently drive, how much difficulty do you have driving at night?	No difficulty at all A little difficulty Moderate difficulty Extreme difficulty I do not drive at night	29 9 2 0 6
If you do not drive at night, what is the reason?	Because of your current eyesight Because you are not interested in driving Because you have other reasons I drive at night	5 62 2 31
How satisfied are you with your cataract surgery result?	Dissatisfied/very dissatisfied Neither satisfied nor dissatisfied Satisfied /very satisfied	1 2 97
Would you recommend the cataract surgery and new lenses that were put into your eyes to other people?	No Yes	2 98

haloes at night, which were graded mild in severity. 9% of patient had little difficulty in night driving. Only 5% of patients do not drive at night due to their current eyesight. 97% patient was satisfied with their cataract surgery.

Tae im Kim et al 1 at our study also have similar finding in their studies.

CONCLUSION

Cataract surgery with bilateral implantation of apodised diffractive multifocal IOL have improved quality of life in active patients who wish to reduce their dependence on glasses. This IOL give good distance and near visual acuity. Therefore, by using multifocal IOL, patient becomes spectacle independence in majority of cases. The quality of life questionnaire confirm that patient underwent cataract surgery with multifocal IOL have high level of satisfaction. However, patients have more glare and haloes as compared to traditional Monofocal IOL.

Outcome of this study should be confirmed with long-term studies with large sample size.

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