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RESEARCH ARTICLE

COMPARISON OF VISUAL OUTCOME IN MONOFOCAL VERSUS MULTIFOCAL IOL

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ABSTRACT

Introduction: The goal of cataract surgery has changed from mere restoration of vision to attaining spectacle independence. While the introduction of phacoemulsification and foldable monofocal IOLs led to spectacle free vision only for distance, multifocal IOLs led to complete spectacle independence for both distance as well as for near, but with its own set of drawbacks.

Material and Methods: A prospective interventional study consisting of 50 eyes of 50 patients divided into two groups of 25 each. Group A underwent monofocal IOL implantation while group B underwent multifocal IOL implantation.

Results: Group A didn't experienced glare, haloes, reduction of contrast sensitivity and complete spectacle independence. Group B experienced glare and haloes in 12 (48%) patients, reduction of contrast sensitivity in 25 (100%) patients, and spectacle independence in 12 (48%) patients.

Conclusion: Multifocal IOLs can lead to complete spectacle independence but associated with disturbing phenomenon of glare, halos and reduction in contrast sensitivity. Further improvement in design of multifocal IOLs is suggested.

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INTRODUCTION

The cataract surgery involves the removal of cataract and implantation of intra ocular lens (IOL). The cataract surgery which was once considered a simple procedure just to regain vision has evolved into a highly skilled and very precise surgery to attain spectacle free vision. From the earlier era of just removing the cataract and rendering the patient aphakic forcing the compulsory use of post operative thick glasses for both distance as well as near, the science had advanced to the high magnification ophthalmic microscope aided extracapsular cataract surgery with implantation of rigid monofocal intraocular lens. With the introduction of phacoemulsifaction and foldable monofocal IOLs, astigmatic neutrality could be achieved leading to spectacle free vision for the distance. But this necessitated the use of reading glasses for near work (Javitt *et al.,* 1997). As the IOL technology kept evolving, multifocal IOLs were introduced that were aimed at achieving complete spectacle independence, not only for distance but also for near. But multifocal IOL technology had its own set of drawbacks such as glare, halos, and reduction of contrast sensitivity (Holladay *et al.,* 1990, Lang *et al.,* 1993).

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It has led to a lot of confusion amongst the patients as well as the surgeons making it difficult to choose one of them. Controversy has been building up around these two leading IOL technologies. This is an attempt to study and compare and thereby help in resolving the controversy by studying the visual outcome of these two leading IOL technologies.

MATERIALS AND METHODS

This is a prospective interventional study in which patients with immature senile cataract nuclear sclerosis (NS) grade 2 or 3 were included. Any patient with corneal opacity, corneal astigmatism more than 1 D, pesudoexfoliation, lens subluxation, vitreoretinal disorders, amblyopia, were excluded. The diminution of visual acuity not explainable by the underlying density of cataract was also excluded. A total of 50 eyes of 50 patients were selected which were randomly divided into 2 groups. Informed consent was obtained. All the patients underwent a detailed ophthalmic examination including Visual acuity, Colour vision, non contact applanation tonometry, slit lamp examination and fundus examination by direct as well as indirect ophthalmoscopy. The patients were randomly divided into 2 groups- group A (25) and group B (25). All the patients underwent phacoemulsification under topical anesthesia (proparacaine 5% eye drop) by the same surgeon (RM). Group A were implanted with hydrophilic acrylic foldable monofocal IOL while group B with refractive multifocal IOL. Post

operatively detailed ophthalmic examination was done and they were evaluated specifically for subjective visual complaints, visual acuity, contrast sensitivity, stereopsis, and visual field at day 1, 7 and 30.

RESULTS

A total of 50 eyes of 50 patients were evaluated . The patients were randomly divided in 2 groups of 25 each.

Table 1. Distribution of patients reandomized to different groups

Group A (Monofocal IOL)	Group B (Multifocal IOL)
25	25

Of the 25 eyes randomized to group A, males were 15. Of the 25 randomized to group B, 13 were males.

Table 2. Distribution of patients according to age and sex

	Group A (%)	Group B(%)
Males	15 (60%)	13(52%)
Females	10(40%)	12(48%)
Total	25	25

Grades of cataract was nuclear sclerosis (NS) was distributed as follows among the 2 groups:

Table 3. Distribution of patients according to grade of cataract

	NS- II	NS- III
Group A	11 (44%)	14(56%)
Group B	15 (60%)	10(40%)
	26(52%)	24 (48%)

Grades of cataract of group A were further subdivided as follows:

Table 4. Distribution of patients of group A according to grade of cataract and sex

	NS-II	NS-III
Males	7	8
Females	4	6

Grades of cataract of group B were further subdidivided as follows:

Table 5. Distribution of patients of group B according to grade of cataract and sex

	NS-II	NS-III
Males	8	5
Females	7	5

Outcome in terms of glare and haloes: While none of the patients experienced glare and haloes in group A , 12 patients out of 25 (48%) experienced these phenomenon. It was distributed as follows:

Table 6. Distribution of glare and halos amongst different groups

Group A	Male	0
	Female	0
Group B	Male	5 (38.46%)
	Female	7 (58.33%)

While a reduction in contrast sensitivity was not experienced in any patient in group A, all the 25 patients in group B experienced the same. It was distributed as follows:

Table 7. Distribution of contrast sensitivity amongst different groups

Group A	Male	0
	Female	0
Group B	Male	13(100%)
	Female	12 (100%)

The ability to read the near chart was not observed in any patient in group A while it was found in 12 (48%) of patients in group B. It was distributed as follows:

Table 8. Distribution of spectacle freedom for near vision amongst different groups

Group A	Male	0
	Female	0
Group B	Male	7 (53.84%)
	Female	5 (41.66%)

Conclusion

While the monofocal IOL provides a crystal clear visual acuity but mandatory reading glasses, multifocal IOL provides spectacle independence but at the cost of poor contrast sensitivity and undesirable symptoms. The multifocal IOL in order to achieve images at all distances have refractive or diffractive optics. Some IOLs have 6 concentric rings (Pepose *et al.,* 2007; Lane *et al.,* 2006) while some have up to 12 rings (Davison *et al.,* 2006*;* Souza *et al.,* 2006). These rings lead to intraocular light-scatt ering and higher order aberrations due to refractive or diff ractive optics which in turn lead to poor retinal image quality and consequently poor contrast sensitivity and disturbing visual phenomenon. Some nonrandomized studies arrived at a conclusion that the quality of vision in multifocal IOL is good (Knorz *et al.,* 1993; Lindstrom *et al.,* 1993, Gimbel *et al.,* 1991). It has been reported report that 68% of multifocal patients as compared to 78% of monofocal patients were satisfied with their surgery (Rossetti *et al.,* 1994). Ironically they also reported that 82% of the multifocal group and 67% of the monofocal group had good vision. In our study glare and halos reported in 48% of multifocal IOL. There have been some earlier studies that also reported glare and halos with the multifocal IOLs (Percival *et al.,* 1993; Kamlesh *et al.,* 2001). As compared to glare, halos were more frequent (Allen *et al.,* 1996; Javitt *et al.,* 2000; Rossetti *et al.,* 1994). In our study females observed more glare and halos as compared to males.Spectacle independence is more likely to be achieved with use of the multifocal IOL than monofocal IOLs. But in our study only 48% of multifocal patients could read newspaper without spectacles. Similarly, a meta analysis of multifocal IOLs showed that spectacle independence could not be achieved in at least half of the participants (Martin Leyland, *et al.,* 2003). In our study all the patients with multifocal IOL reported reduction in contrast sensitivity. Similarly several studies have reported reduction in contrast sensitivity (Javitt *et al.,* 1997; Javitt *et al.,* 2000; Pieh *et al.,* 2002; Chang *et al.,* 2008; Alió *et al.,* 2005; Cillino *et al.,* 2008; Chiam *et al.,* 2007; Pepose *et al.,* 2007). In a study comprising of bilateral multifocal IOL implantation, it demonstrated significantly

reduced contrast sensitivity compared with a monofocal IOL control group (Arens *et al.,* 1999). There have been attempts to improve the IOL design to minimse the disturbing visual phenomenon. Modified prolate optic surfaces tend to reduce the spherical aberration in the eye, thereby improving visual quality (Rawer *et al.,* 2005; Bellucci *et al.,* 2004; Holladay *et al.,* 2002; Franchini *et al.,* 2007). However, achieving spectacle independence with a good visual quality is quite challenging (Pepose *et al.,* 2008; Kohnen *et al*., 2008). Our study highlights the fact monofocal IOL provide a good visual quality as compared to multifocal IOL. Ironically, multifocal IOL could not achieve the sole purpose of spectacle independence even in half of the study participants. The limitation of our study was small number of participants, uniocular surgery, lack of quantification of contrast sensitivity, and subjective bias of the participants. Therefore to overcome the limitations of this study, we are of an opinion that a large study aimed at bilateral multifocal IOLs with quantification of contrast sensitivity parameters be conducted.

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