Which is better: Multifocal or Monofocal IOL?

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ABSTRACT
A comparative study was conducted for assessing multifocal IOLs and standard monofocal lenses on visual acuity, subjective visual satisfaction, spectacle dependence, glare and contrast sensitivity among two groups of 20 patients each undergoing cataract surgery in a tertiary care hospital. First and Second Group were implanted with refractive-diffractive multifocal IOL and monofocal IOL of the same material respectively. Lenticular opacity grading, corneal astigmatism, axial length, and refractive status of each patient were assessed pre-operatively. Uncorrected visual acuity, best corrected visual acuity, distance vision, near vision, spectacle dependency and subjective satisfaction of each patient were noted post operatively on completion of Day 1, Week 1, Month 1 and Month 3. The uncorrected near visual acuity was significantly better in multifocal group, whereas the corrected distance visual acuity was better in the monofocal group. Patients with monofocal IOL reported fewer problems with nighttime driving and halos. The multifocal IOLs provided better near vision and significantly reduced spectacle dependency as compared to monofocal IOLs.

KEY WORDS: cataract surgery, intraocular IOL, multifocal IOL

INTRODUCTION:
Advances in intraocular lens (IOL) design and surgical techniques have significantly improved the visual outcomes of cataract surgery. Traditional monofocal IOLs provide excellent visual acuity (VA). However, they have a fixed focal distance and limited depth of focus. Patients with monofocal IOLs lose most of their accommodation and usually require glasses for near vision. Several materials are used to compensate for the loss of accommodation from implantation of an intraocular lens (IOL), including multifocal IOLs [1-6] accommodating IOLs [7] and monovision [8-9].

The introduction of multifocal intraocular lenses (MIOLs) in early 1980s presented the possibility of attaining good binocular uncorrected distance and near vision [10-13]. With such potential associated with greater spectacle freedom and improved life quality; MIOLs are growing in popularity [14-16]. Refractive IOLs have a central near vision segment surrounded by a distance vision segment. Anulus design multifocal IOL have a central portion which contains distance vision refraction & near vision ring outside it, surrounded by a distance vision ring. Diffractive IOLs have near & distance correction put in each of the concentric rings. They consist of front convex surface with 25 concentric annual zones cut on the posterior surface with microscopic steps between coterminous annuli.

MATERIALS AND METHODS:
Subjects:
We designed a case-controlled study to include the eyes of 40 unilateral cataract patients who requested a surgical refractive solution to improve near and far vision. The patients underwent cataract surgery in the Department of Ophthalmology, Mahatma Gandhi Hospital, Sitapura, Jaipur. All the patients were counseled about the realistic expectation of the IOL and signed an informed consent. Prior approval was taken by the Ethics Committee. The inclusion criteria were eyes with significant cataract, age 40-70 yrs, visual potential up to 6/9 or better, uneventful surgery. The exclusion criteria included Corneal astigmatism>1.50D and any other ocular disease (corneal disease, macular degeneration).
Preoperative Examination:
Preoperatively, all patients received a full ophthalmologic examination, including evaluations of the radius of corneal curvature, corneal astigmatism, axial length, refractive status, distance and near visual acuity, an anterior segment evaluation using a slit lamp, tonometry and indirect fundoscopy.

Uncorrected distance visual acuity (UDVA) and corrected distance visual acuity (CDVA) were measured at 6 m with standard Snellen’s chart. Uncorrected near visual acuity (UNVA) and corrected near visual acuity (CNVA) were measured at 30 cm.

Postoperative Examination:
Patients were scheduled for clinical evaluation preoperatively and postoperatively at 1 day, 1 week, 1 month and 3 months. A standard ophthalmologic examination was performed at all visits and included manifest refraction, slit lamp biomicroscopy and binocular indirect ophthalmoscopy.

Surgical technique:
More than one experienced surgeons performed sutureless phaco-emulsification in all cases. After local anesthesia was administered, a 3.0 mm clear corneal incision was made. After complete hydro-dissection, a continuous curvilinear capsulorhexis 5.0 mm-5.5 mm was created. The lens was removed and the posterior lens capsule polished. The capsular bag was refilled with the ophthalmic viscosurgical device (OVD) and the IOL was injected into the bag with an injector. The IOL was centered in the capsular bag. The OVD was aspirated from the anterior chamber and capsular bag and from behind the IOL. IOL centration and haptic configuration were rechecked, and the anterior chamber was refilled with a balanced salt solution.

Both the groups were unilaterally implanted with foldable hydrophilic, square edge, aspheric, acrylic intraocular lens. Group A was implanted with aspheric refractive-diffractive multifocal IOL with +3.5 D addition. Group B was implanted with same material monofocal IOL.

Patient Questionnaire:
A written question survey assessing the lifestyle impact of IOL implantation was administered 3 months postoperatively. The survey included questions about the visual difficulty of performing everyday tasks such as reading newspaper, using computer, cooking, watching television, shopping and so on. Patient satisfaction was based on questions about distance, near and night vision.

RESULTS:
Twenty patients were implanted with multifocal IOLs and 20 patients were implanted with monofocal IOLs unilaterally. The mean age range was between 40-70 years (Mean ±SD= 59.45 ± 9.13) for the multifocal group & (61.11 ± 7.54) for the monofocal group. There was no significant difference between the two groups.

Postoperatively, all patients had uncorrected distance acuity of 0.5 P value or better. Uncorrected distance acuity of 6/9 or better was achieved in 95% eyes in the multifocal group and 95% in the monofocal group. No significant difference was noted among the two groups.

A significant greater proportion of patients in the multifocal group compared to in the monofocal group achieved an uncorrected near visual acuity of N8 or better. 80% patients in the multifocal group achieved an uncorrected near visual acuity of N6.

Table I and II shows the comparative analysis of postoperative visual acuity between the two groups. Table I and II shows the comparative analysis of postoperative visual acuity between the two groups.

Table 1: Uncorrected visual acuity for Distance

<table>
<thead>
<tr>
<th></th>
<th>GROUP A</th>
<th>GROUP B</th>
</tr>
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<tbody>
<tr>
<td>6/6</td>
<td>70%</td>
<td>40%</td>
</tr>
<tr>
<td>6/9</td>
<td>60%</td>
<td>30%</td>
</tr>
<tr>
<td>6/12</td>
<td>50%</td>
<td>20%</td>
</tr>
</tbody>
</table>

The uncorrected visual acuity for distance is almost same in both the groups. No significant difference was noted. Chi square value is 0.05, p value is 0.0975.

With multifocal IOL implantation, rates of spectacle dependency were reported to be significantly lower than with monofocal IOLs. No patient in the multifocal group wore glasses all the time. Spectacle dependency was defined as the percentage of patients who always or occasionally use...
eyeglasses. Table III and IV shows the spectacle use in both the groups.

Table 2: Uncorrected visual acuity for Near.

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
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</thead>
<tbody>
<tr>
<td>N/6</td>
<td>80%</td>
<td>20%</td>
</tr>
<tr>
<td>N/8</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>N/12</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>N/18</td>
<td>30%</td>
<td>0%</td>
</tr>
<tr>
<td>N/36</td>
<td>60%</td>
<td>0%</td>
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</tbody>
</table>

The uncorrected visual acuity for near is significantly better in group A.
Chi square value is 29.955
P value is 0.00009

Table 3 for Distance.

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEVER</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>OCCASIONALLY</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>ALWAYS</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

The rate of spectacle dependency for distance was same in both the groups and no significant difference was noted. Chi-square statistic is 0.4396. p-value is 0.802695. The result is not significant at p < 0.05.

The rate of spectacle dependency for near was higher in Group B. Chi squared equals 20.051 with 1 degrees of freedom. P value is less than 0.0001
The association is extremely statistically significant

There were no significant differences in any subscale between the groups, and for only one question related to night-time driving did the multifocal group significantly outperform the multifocal group.

DISCUSSION:
The present retrospective study of visual outcome demonstrated the objective of the multifocal IOLs is to reduce spectacle dependency at various distances of visual tasks while providing good vision without sacrificing the quality of vision. Quality of vision includes, among other parameters, halos and glare.

In our prospective study, distance uncorrected visual acuity was good in all patients. However, regarding the results of uncorrected visual acuity for near, it was significantly better in multifocal group. This is similar to former prospective studies comparing multifocal IOLs with monofocal IOLs [20-23]. Approximately 85% of multifocal patients were spectacle independent in our study, a rate consistent with the findings of previous reports of multifocal IOLs in which the percentage ranges from 82.6% to 92.8% [24, 25]. In contrast, the rate of spectacle independence in the monofocal group was approximately 32%. Spectacle independence is the primary reason that patients choose to undergo multifocal IOL implantation; therefore, this result demonstrates that multifocal IOLs meet these expectations. Theoretically, any multifocal IOL may be associated with a decrease in image quality because of the distribution of the light between more than one focal point, and possibly, increased light scatter [26, 27].

Current cataract surgery is very sophisticated and results in a high level of satisfaction; therefore, it may be difficult to detect significant differences in patient satisfaction between the two types of implanted IOLs. However, our results can be interpreted from a different perspective: subjective visual performance of multifocal IOLs is not inferior.
to that of monofocal IOLs. On the other hand, the multifocal group scored significantly worse than the monofocal group in the dimension of nighttime driving. Patients with multifocal IOLs sometimes have difficulty in performing nighttime driving due to decreased contrast sensitivity, glare disability and/or the appearance of halos. Consequently, clinicians should be wary of implanting multifocal IOLs in patients who drive at night.

The overall satisfaction rate in the multifocal group remained high, compared to that in the monofocal group. Similar findings have also been reported in previous studies. None of our patients who experienced visual symptoms was willing to exchange the IOL to alleviate the symptoms. This could be expected in a group of patients that are so keen to be able to read without glasses. This observation may also suggest that the visual symptoms produced by this multifocal IOL tend to be tolerable and fade over time. Overall satisfaction in some patients is not solely guaranteed by good postoperative visual acuity. Quality of vision and self image may be as important for them as visual acuity.

CONCLUSION:

Multifocal IOL implantation is effective in achieving good unaided near and distance vision, provided certain conditions are met. As seen in our study, the mean uncorrected near visual acuity was better and the rate of spectacle dependency was significantly lower in the multifocal group.

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