·Letter to the Editor·

Visual outcomes of multifocal intraocular lens implantation in patients with cataract and high hyperopia and patient selection

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Dear Sir,

The aim of multifocal intraocular lens (IOL) implantation is to reduce spectacle dependence after the operation. The optical designs of multifocal IOLs are based on a number of optical concepts that are used to create multiple foci and therefore to generate simultaneous vision. Multizonal refractive, refractive rotationally asymmetric, diffractive and hybrid apodized (the combination of refractive and diffractive elements) multifocal IOLs are the currently available options. Refractive types have spheric posterior surface and varying optic curvatures to produce focal points on anterior aspheric surface, on the other hand, diffractive types have concentric rings on posterior surface that form two primary focal points independent of pupil size, allowing a functional distance and near vision, respectively[1,2].

A multifocal IOL forms two images of an object at a certain distance, when one of the images is focused, the other one is superimposed or outside the focus. This causes decrease in contrast sensitivity and photic phenomenon which is halos around the lights and objects and the glare. But this situation can be avoided by minimizing the postoperative level of primary spherical aberration [1,3]. Therefore diffractive apodized multifocal IOLs provide better near visual acuity and improve contrast sensitivity and photic phenomenon[4-6].

In this study, 26 eyes of 13 patients with bilateral cataract and high hyperopia, who had undergone bilateral phacoemulsification and multifocal IOL implantation surgery between November 2010 and May 2011, were evaluated retrospectively. Six of them were male (46%) and 7 of them were female (54%). Their mean age was 59.53 ±7.94y (45-71). Eleven eyes (42%) had cortical, 9 eyes (35%) had posterior subcapsular and 6 eyes (23%) had nuclear cataracts. Patients who had any ocular or systemic diseases which might affect the vision and preoperative corneal astigmatism greater than 1 diopter (D), were excluded from the study.

Axial length measurements were made by using IOL Master Optical Biometer (Zeiss, Germany). Hoffer Q formula was used for IOL power calculation due to the presence of high hyperopia. Targeted postoperative refraction was within ±0.50 D. Preoperative and postoperative refractive measurements including spheric eqivalent (SE) and astigmatism, intraocular pressure (IOP) measurements, fundus examination, uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA), uncorrected intermediate visual acuity (UIVA), corrected intermediate visual acuity (CIVA), uncorrected near visual acuity (UNVA), corrected near visual acuity (CNVA), distant CIVA (DCIVA) and distant corrected near visual acuity (DCNVA) measurements were performed. Postoperative measurements were taken on 1d, 1wk, 1, 3, 6mo,1 and 2y. But for statistical analysis 3mo values were taken.

The multifocal IOL used in the operations was Acriva^{UD} Reviol MF613. It has 6.00 mm optic size, 13.00 mm haptic size, its optic design is biconvex, haptic design is modified C. Its premium material is acrylate monomer, its water content is 25%, it has a water resistant hydrophobic surface and ultraviolet (UV) absorbtion property. Its aspheric structure corrects corneal aberrations. Its diffractive surface minimizes unwanted scattered light and halos and it is not affected by pupil size, its all square 360° enhanced edge reduces

posterior capsular opacification (PCO). It has 3.75 D addition power. All statistical analyses were performed using commercially available statistical software (SPSS version 22, SPSS, Inc., Chicago, IL, USA). Statistical significance was defined as $P<0.05$.

The mean axial length was 21.03±0.56 (20.02-22.45) mm. The mean IOL power was 28.61±2.26 (25.00-34.00) D. The mean preoperative SE was 7.88±1.96 (5.00-12.00) D and the mean postoperative SE was 0.47±0.34 (0.00-1.00) D, the difference was statistically significant ($P<0.001$). The mean preoperative astigmatism was 0.36±0.36 (0.00-1.00) D, and the mean postoperative astigmatism was 0.28±0.34 (0.00-1.00) D, the difference was not significant statistically ($P=0.312$). The mean preoperative UCVA was 1.17±0.21 (0.90-1.50) logMAR and the mean postoperative UCVA was 0.04±0.07 (0.00-0.20) logMAR ($P<0.001$). The mean preoperative BCVA was 0.47±0.15 (0.30-0.80) logMAR and the mean postoperative BCVA was 0.01±0.03 (0.00-0.10) logMAR ($P<0.001$). The mean preoperative UIVA was 1.20±0.21 (1.00-1.50) logMAR and the mean postoperative UIVA was 0.03±0.06 (0.00-0.20) logMAR ($P<0.001$). The mean preoperative CIVA was 0.49±0.12 (0.30-0.70) logMAR and the mean postoperative CIVA was 0.01±0.03 (0.00-0.10) logMAR ($P<0.001$). The mean preoperative UNVA was 1.27±1.17 (1.10-1.50) logMAR and the mean postoperative UNVA was 0.06±0.08 (0.00-0.20) logMAR ($P<0.001$). The mean preoperative CNVA was 0.51±0.14 (0.30-0.70) logMAR and the mean postoperative CNVA was 0.01±0.03 (0.00-0.10) logMAR ($P<0.001$). The mean postoperative DCIVA was 0.03±0.07 (0.00-0.20) logMAR and DCNVA was 0.03±0.07 (0.00-0.20) logMAR.

Postoperatively one patient used spectacles for distance vision, one patient used for near vision and one patient used for both distance and near vision. So, the total postoperative spectacle dependence percentage was 23%. Two patients complained of halos up to postoperative 3mo (15%) and 2 patients complained of glare up to postoperative 4mo (15%). PCO developed in 1 eye in postoperative 6mo and 2 eyes at the end of 1y postoperatively (11.5%). After YAG laser capsulotomy they had no problem. Seventy-seven percent of the patients were within the targeted refraction (±0.50 D), postoperatively. When we asked the patients 84% of them said that they were satisfied with this operation and recommended this operation to other people.

It's not always easy to provide satisfaction for the patients after multifocal IOL implantation. The causes of dissatisfaction are generally blurred vision due to ametropia, photic phenomenon, decreased contrast sensitivity and personality of the patient[7].

Patient selection is very important. Lifestyle, occupation and expectations of the patient should be questioned. Perfectionist personalities are usually difficult to be managed. Astigmatism more than 1 diopter may deteriorate postoperative vision. Regular astigmatism may be corrected, but irregular astigmatism may remain as a challenge. Patients should be informed that there might be refractive surprises or residual refractive errors after the operation, and they might require additional surgical procedures like LASIK. In case of high astigmatism, toric multifocal IOLs may be a choice to achieve spectacle independence[7,8].

Dry eye, pterygium, corneal dystrophies and scars should be evaluated before the surgery and if treatable they may not be contraindication for multifocal IOL implantation [9]. Patients who had radial keratotomy (RK), photorefractive keratectomy (PRK) or LASIK beforehand, are not good candidates for multifocal IOL implantation. Because they have corneal aberrations causing a multifocal cornea, the implantation of a multifocal IOL into such an eye may result in additional loss of contrast sensitivity leading to reduction in visual quality[10].

The size and shape of pupil is also important, patients with a large pupil are more likely to have glare postoperatively. Small pupils need expansion during the surgery, iris sphincter may be damaged due to this expansion procedure, thus iatrogenic mydriasis leading to glare may develope[11].

Zonular weakness may cause decentration or tilt of IOL, this is important for multifocal IOLs, because it may cause decreased contrast sensitivity, decreased visual acuity and low visual quality. In this case capsular tension ring (CTR) can be used for stabilization of the posterior capsule[12].

Optic nerve abnormalities and retinal diseases such as macular degeneration, diabetic retinopathy, retinitis pigmentosa and Stargardt disease decrease contrast sensitivity, in the presence of these diseases, implantation of multifocal IOL will duplicate the contrast sensitivity reduction, hence retina should be assesed carefully before deciding the operation[13].

Patients who have strabismus and/or amblyopia, cannot achieve the summation benefit of simultaneous binocular multifocal vision. In high hyperopic patients, there may be small angle esotropia and amblyopia, that's why, we should make sure that the patient is a monofixator before the operation. Also in amblyopic patients, contrast sensitivity is already decreased and implantation of the multifocal IOLs in these patients will impair contrast sensitivity and visual acuity more[7]. In this study, our patients had neither esotropia nor amblyopia, they all were monofixators.

Multifocal IOLs can also be used in hyperopic patients without cataract for refractive aim. Fernandez-Vega *et al*[14] reported that bilateral implantation of the Acri. LISA 366 D in patients with high hyperopia provided a satisfactory full range of vision comparable with that obtained in patients with low to moderate hyperopia.

Ferrer-Blasco *et al*[15] reported that refractive lens exchange with implantation of a diffractive multifocal IOL in hyperopic eyes gave good distance and near contrast sensitivity under photopic and mesopic conditions. In the literature, we have seen no multifocal IOL implantation study on patients with both cataract and high hyperopia.

In our patients, we got good results for distance, intermediate and near visions. Spectacle dependence rate after the operation was low, satisfaction rate was high. The worse the vision before the surgery is, the more likely the patient is satisfied with the result. That's why, high hyperopic cataract patients are good candidates for multifocal IOL implantation.

In conclusion, diffractive multifocal acrylic Acriva^{UD} Reviol MF613 IOL provided decreased level of spectacle dependence, high distance, intermediate and near visual acuities and low residual refractive errors. But, the selection of the patient is very important for multifocal IOL implantation.

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