Visual Outcomes After Implantation of an Aspheric Diffractive Multifocal Intraocular Lens

Asferik Difraktif Multifokal Göz İçi Lensi İmplantasyonu Sonrası Görsel Sonuçlar

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ABSTRACT Objective: To evaluate distance, intermediate and near vision and contrast sensitivity in patients with implantation of aspheric diffractive multifocal (Acriva Reviol MFM611) intraocular lens (IOL) after cataract surgery. **Material and Methods:** Forty eyes of 20 patients were included in the study. Preoperative and postoperative 1 and 12 months, monocular logarithm of the minimum angle of resolution (log MAR) uncorrected and corrected distance visual acuity, distance-corrected near and intermediate visual acuity and contrast sensitivity were evaluated. Photopic contrast sensitivity was evaluated at 1.5, 2.52, 4.23, 7.10 and 11.91 cycles per degree spatial frequencies by CC-100 Topcon LCD. **Results:** One-year postoperatively, the mean uncorrected and corrected distance visual acuity, distance-corrected near and intermediate visual acuity were statistical significantly better than preoperative levels (p=0,0001).The mean photopic contrast sensitivity increased considerably at all spatial frequencies compared with preoperative levels (p=0,0001). There was no significant difference in the mean uncorrected distance visual acuity (p=0,458), distance-corrected near (p=0,157) and intermediate (p=0,157) visual acuity between postoperative 1 and 12 months values. One-month postoperatively, the mean corrected distance visual acuity was significantly better than postoperative 12 months' value (p=0,007). The aspheric diffractive multifocal IOL Acriva Reviol MFM611, provided good distance, intermediate and near visual acuities and satisfaction for distant contrast sensitivity under photopic condition in patients who had undergone cataract extraction by phacoemulsification technique. Patients have no compliant of severe or moderate glare and halos. **Conclusion:** The Acriva Reviol MFM611 multifocal IOL provided predictable good visual outcomes.

Key Words: Phacoemulsification; lens implantation, intraocular; visual acuity;
contrast sensitivity

ÖZET Amaç: Katarakt cerrahisi sonrası, asferik difraktif multifokal (Acriva, Reviol MFM611) göz içi lensi implantasyonu yapılan hastalarda, uzak, ara ve yakın mesafe görme keskinliği ve kontrast duyarlılık değerlendirilmesi. **Gereç ve Yöntemler:** Yirmi hastanın 40 gözü çalışmaya alındı. Hastaların ameliyat öncesi ve sonrası 1. ay ve 1. yıl, ortalama rezolüsyonun minimum açısının monoküler logaritmi (log MAR) düzeltilmemiş uzak görme keskinliği, en iyi düzeltilmiş uzak, ara ve yakın mesafe görme keskinliği ile kontrast duyarlılığı değerlendirildi. Kontrast duyarlılık;1.5, 2.52, 4.23, 7.10 ve 11.91 devir/derece uzaysal frekanslarda fotopik ortamda CC-100 Topcon LCD ile ölçüldü. **Bulgular:** Hastaların ameliyat sonrası 1. yıl, ortalama log MAR düzeltilmemiş ve en iyi düzeltilmiş uzak görmeleri, ameliyat öncesi değerlere göre istatistiksel anlamlı olarak daha iyiydi (p=0,0001). En iyi düzeltilmiş ara ve yakın mesafe görme keskinliği, ameliyat öncesi değerlere göre istatistiksel anlamlı olarak daha iyiydi (p=0,0001). Ölçülen tüm uzaysal frekanslardaki ortalama fotopik kontrast duyarlılık ölçümleri, ameliyat öncesi değerlere göre istatistiksel anlamlı olarak daha iyiydi (p=0,0001).Hastaların ameliyat sonrası 1. ay ve 1. yıl, ortalama log MAR düzeltilmemiş uzak (p=0,458), en iyi düzeltilmiş ara (p=0,157) ve yakın mesafe görme keskinliği (p=0,157) sonuçları arasında istatistiksel olarak anlamlı fark gözlenmezken; ameliyat sonrası 1. ay log MAR en iyi düzeltilmiş uzak mesafe görme keskinliği, ameliyat sonrası 1. yıl sonuçlarına göre istatistiksel olarak anlamlı derecede iyi bulundu (p=0,007). Katarakt cerrahisi sonrası asferik difraktif multifokal GİL Acriva Reviol MFM611 implantasyonu yapılan hastalarda uzak, ara ve yakın mesafede iyi görme keskinliği ve fotopik ortamda kontrast duyarlılıkta artış sağlandı. Hiçbir hastada orta veya şiddetli kamaşma ve halo şikayeti olmadı. **Sonuç:** Acriva Reviol MFM611 multifokal GİL ile öngörülebilen iyi görsel sonuçlar elde edildi.

Anahtar Kelimeler: Fakoemülsifikasyon; lens implantasyonu, göz içi; görme keskinliği;
kontrast duyarlılığı

Multifocal intraocular lenses (IOLs) have evolved significantly over the past few years. They have the advantage of providing the patient with good near, intermediate and distance visual function.[1-4] However, they also have optical side effects, such as decreased contrast sensitivity, glare disability or the presence of halos.[5,6] These side effects reduce retinal image quality and it can significantly affect the patient's visual acuity.

Many types of multifocal IOLs are available. They are categorized as diffractive IOLs and refractive IOLs based on lens design. The Acriva Reviol MFM611 is an aspheric diffractive multifocal IOL which has biconvex 6.00 mm optic size and plate 11 mm haptic size. The lens is available in spherical powers ranging from 0.00 D to +45.00 D in 0.50 increments. The add power of the IOL is + 3.75 D at the lens.

The purpose of this study was to evaluate distance, intermediate and near vision and distance contrast sensitivity under photopic conditions in patients who had implantation of aspheric diffractive multifocal IOLs after cataract surgery.

MATERIAL AND METHODS

This retrospective study comprised patients having cataract surgery with implantation of multifocal IOL from December 2009 to April 2010. All patients were adequately informed and signed a consent form. The study adhered to the tenets of the Declaration of Helsinki. Exclusion criteria were ocular pathology other than cataract, illiteracy and corneal astigmatism greater than 1.25 diopters (D).

SURGICAL TECHNIQUE

The surgery performed by experienced surgeon (L.A). A 2.8 mm clear incision was placed at the steepest meridian. A standard sutureless phacoemulsification technique was used. The multifocal IOLs were injected into the capsular bag.

PREOPERATIVE AND POSTOPERATIVE EXAMINATIONS

Preoperatively and postoperative 1 day, 1week,1 and 12 months, all patients had a standard ophthalmologic examination including manifest re-

fraction, monocular near, intermediate and distance visual acuities, distance contrast sensitivity under photopic (85 candelas /m^2) conditions with the Topcon LCD, slitlamp biomicroscopy, Goldmann applanation tonometry and fundoscopy. Distance visual acuity was measured with Snellen chart and near and intermediate visual acuity with Jaeger chart. The measured visual acuities were converted into their log MAR values. Subjective complaints of patients such as halo and glare were also evaluated postoperative 1-year.

STATISTICAL ANALYSIS

Statistical analysis was performed using NCSS (Number Cruncher Statistical System) 2007 statistical software (Utah, USA). Beside definitive statistical analysis (Average, Standard Deviation), Friedman test at repeated measures and Dunn's multiple comparison test in subgroup comparison have been used in assessment of data. For all statistical tests, the level of significance was P< 0,05.

RESULTS

Forty eyes of 20 patients ranging in age from 36 to 77 years were included in this study. Table 1 shows the preoperative patients' data. There were no intraoperative complications. All eyes had good IOL centration after surgery and IOL implantation. Posterior capsule opacification was present in no eyes and patients have no compliant of severe or moderate glare and halos 1-year postoperatively.

VISUAL ACUITY AND REFRACTION

Table 2 shows the visual and refractive outcomes 1 and 12 months postoperatively. Patients had a statistically improvement in monocular logarithm of the minimum angle of resolution (log MAR) uncorrected (UDVA) and corrected (CDVA) distance visual acuity after one year surgery (p=0,0001 Dunn's multiple comparison test). There was no statistically significant difference in UDVA between postoperative 1 and 12 months (p=0,458 Dunn's multiple comparison test) but not in CDVA. Postoperative 1-month, CDVA was statistically significant better than 12 months postoperatively (p=0,011 Dunn's multiple comparison test) (Figure 1 and 2). The im-

TABLE 1: Preoperative patient' data.	
Characteristic	**Value**
Eyes (n)	40
Mean age (y)± SD	62 ± 19,11
Gender (male/female)	9/11
*LogMAR UDVA	
Mean ± SD	0,74 ± 0,46
Range	0,30 to 1,60
Sphere (D)	
Mean ± SD	1,57 ± 1,6
Range	-1,00 to 4,50
Cylinder (D)	
Mean ± SD	-0,03 ± 0,85
Range	-1,00 to 1,25
*LogMAR CDVA	
Mean ± SD	0,52 ± 0,43
Range	0,10 to 1,60
*LogMAR DCNVA	
Mean ± SD	0,26 ± 0,07
Range	0,10 to 0,30
*LogMAR DCIVA	
Mean ± SD	0,26 ± 0,07
Range	0,10 to 0,30

CDVA = corrected distance visual acuity; DCIVA = distance-corrected intermediate visual acuity; DCNVA = distance-corrected near visual acuity; UDVA = uncorrected distance visual acuity;*= monocular

provement in monocular log MAR distance-corrected near (DCNVA) and distance-corrected intermediate (DCIVA) visual acuity was statistically significant one year after surgery (p=0.0001 Dunn's multiple comparison test). There was no statistically significant difference in DCNVA and DCIVA between postoperative 1 and 12 months (p=0.157 Dunn's multiple comparison test). According to Jaeger values, 90% of eyes had DCNVA and DCIVA of J1 and 10% had J2 1-month postoperatively, 80% and 20% 1-year postoperatively.

The decreased in the mean spherical error was statistically significant (p=0.016 Dunn's multiple comparison test) but not in the mean cylindrical error (p=0.234 Dunn's multiple comparison test) after one year surgery.

CONTRAST SENSITIVITY OUTCOMES

Figure 3 shows the improvement in contrast sensitivity under photopic conditions at all spatial fre-

quencies. The mean contrast sensitivity increased statistically significant at all spatial frequencies compared with preoperative levels (p=0.0001).

TABLE 2: Comparison of 1 and 12-month postoperative patient data.			
Parameter	**1-month**	**12-month**	**p value**
*LogMAR UDVA			
Mean ± SD	0,19 ± 0,13	0,2 ± 0,12	0,458
Range	0,00 to 0,40	0,10 to 0,40	
Sphere (D)			
Mean ± SD	0,1 ± 0,57	0,16 ± 0,51	0,273
Range	-1,25 to 1,25	-1,00 to 1,00	
Cylinder (D)			
Mean ± SD	-0,49 ± 0,72	-0,36 ± 0,39	0,234
Range	-1,50 to 1,50	-1,00 to 1,00	
*LogMAR CDVA			
Mean ± SD	0,1 ± 0,1	0,14 ± 0,09	0,011
Range	0,00 to 0,30	0,00 to 0,30	
*LogMAR DCNVA			
Mean ± SD	0,01 ± 0,03	0,02 to 0,04	0,157
Range	0,00 to 0,10	0,00 to 0,10	
*LogMAR DCIVA			
Mean ± SD	0,01 ± 0,03	0,02 to 0,04	0,157
Range	0,00 to 0,10	0,00 to 0,10	

CDVA = corrected distance visual acuity; DCIVA = distance-corrected intermediate visual acuity; DCNVA = distance-corrected near visual acuity; UDVA = uncorrected distance visual acuity; *= monocular
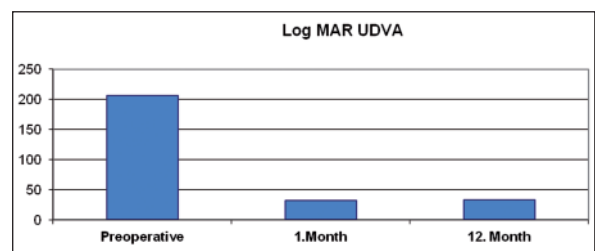
FIGURE 1: Mean monocular log MAR uncorrected distance visual acuity. UCDA= uncorrected distance visual acuit , y-axis:logMAR values.
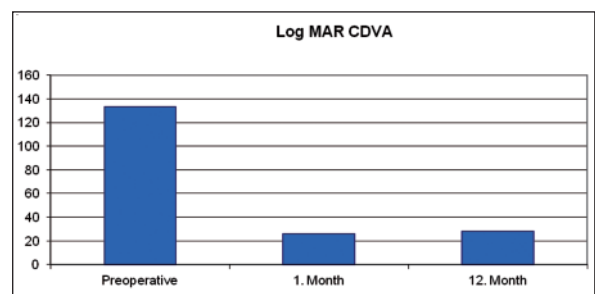
FIGURE 2: Mean monocular log MAR corrected distance visual acuity. CDVA= corrected distance visual acuity, y-axis: logMAR values.
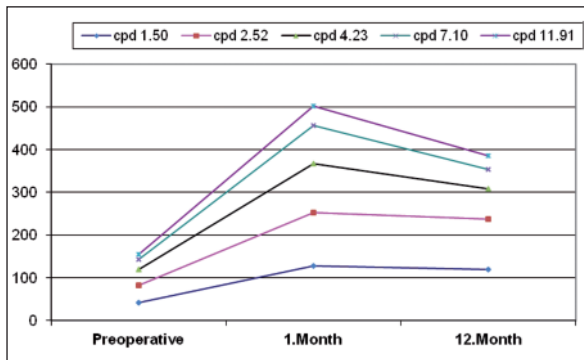
FIGURE 3: Mean contrast sensitivity under photopic conditions (85 cd/m²).
cpd = cycles per degree.
(See for colored form http://oftalmoloji.turkiyeklinikleri.com/)

DISCUSSION

Several studies have confirmed the efficacy of multifocal IOLs in providing a good distance, near and even intermediate vision.[4,7-12] These IOLs were developed to provide functional near and intermediate vision by increasing the depth of field in the eye.[7] In our study, as expected, patients had a significant improvement in distance visual acuity after IOL implantation. Seventy five percent of patients achieved ≥20/30 UDVA and 85% achieved CDVA after 1-year surgery. This is consistent with findings in other studies about multifocal IOLs.[2,8-13] Near and intermediate visual acuity also improved 12 months postoperatively. Distance-corrected near and intermediate visual acuity was ≥J2 (20/25) in all patients and was J1 (20/20) in 80% of eyes. Similar to other studies, there was statistically significant improvement in near and intermediate visual acuity.[2,4,8,9,14] The present study has limitations. We know refractive IOL was better in intermediate and diffractive IOL was better in near vision[12] but we could not compare refractive and diffractive IOL.

Several studies report lower photopic contrast sensitivity with a multifocal IOL than with a monofocal IOL; however, the contrast sensitivity was still within the normal range.[5,15,16] We did not compare multifocal IOL and monofocal IOL. The result in our study showed that patients had a significant improvement in contrast sensitivity under photopic conditions at all spatial frequencies (Figure 1).

Studies of different multifocal IOLs report that the patients experienced significantly more glare and halos.[2,6,15] In our study, all patients showed good performance in terms of distance, near and intermediate visual acuity. Patients asked halos and glare as none to severe and no patient reported severe or moderate dissatisfaction with the multifocal IOL also request IOL exchange.

In summary, evidence from numerous studies supports that multifocal IOLs provide improved distance, near and intermediate visual acuity. The Acriva Reviol MFM611 multifocal IOL, as expected, performed good distance visual function after cataract surgery and improved intermediate and near vision. But we need further studies of the efficacy of Reviol MFM611 IOL implantation to compare our results.

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