JKAU: Med. Sci., **Vol. 19** No. 4, pp: 47-60 (2012 A.D. / 1433 A.H.)
DOI: 10.4197/Med. 19-4.3

Multifocal versus Monofocal Intraocular Lens: Retrospective Comparative Evaluation of Visual Acuity, Spectacle Dependency and Patient Satisfaction

Saad A. Waheeb, MD

Department of Surgery, Faculty of Medicine, King Abdulaziz University
King Faisal Specialist Hospital & Research Center-Jeddah
Jeddah, Saudi Arabia
saadwaheeb@hotmail.com

Abstract. To compare visual outcome, subjective visual experience, and satisfaction between eyes with multifocal intraocular lens and monofocal intraocular lens. This is a retrospective chart review of 39 eyes of 20 patients in Group A, who received multifocal intraocular lens. At 6 months postoperative; uncorrected, best corrected distance visual acuity and near visual acuity were collected. Patients' self responses questionnaire on spectacle dependency, visual phenomena and overall satisfaction was considered. Results were compared with those in 40 eyes (20 patients) Group B implanted with the SA60AT monofocal IOL as a control group. Uncorrected distance acuity of 0.7 was achieved in 87.2% eyes in the multifocal group; 90.0% in the monofocal group and of 0.8 or better, in 74.4% and 70.0%, respectively. Best corrected distance acuity of 0.8 was achieved in all eyes in both groups and of 0.9-1.0 in about 95.0% in both groups. The mean postoperative spherical error was + 0.30 diopter in the multifocal group and - 0.14 diopter in the monofocal group. Multifocal intraocular len patients reported reduced dependency upon glasses for all distances. Multifocal group experienced significantly more halos and glare.

Keywords: Multifocal intraocular lens, Patient satisfaction, Spectacles independence.

Introduction

Restoring unaided full-range functional vision is an ultimate goal after cataract extraction. The introduction of multifocal intraocular lenses

Correspondence & reprint request to: Dr. Saad A. Waheeb
P.O. Box 40047, Jeddah 21499, Saudi Arabia
Accepted for publication: 07 March 2012. Received: 14 October 2011.

(MIOLs) in early 1980s presented the possibility of attaining good binocular uncorrected distance and near vision[1-4]. With such potential associated with greater spectacle freedom and improved life quality; MIOLs are growing in popularity[5-7]. Still some drawbacks are inherent to their design and work principle; multifocality and simultaneous vision[8]. Dividing incoming light into more than one focus; presents more than one image of the same object at the same time; decreasing total light dedicated for each image. And, at least theoretically, decreasing image quality by decreasing contrast sensitivity[9], plus increasing photic phenomena[10,11] and increasing retinal stray light through increased scatter[12].

Subjects and Methods

The charts of our patients who underwent uneventful standard phacoemulsification procedure, and received the ReSTOR IOL (model SN60D3, Alcon Laboratories Inc. Fort Worth, Texas, USA) at King Faisal Specialist Hospital & Research Center-Jeddah were retrospectively reviewed. 39 eyes of 20 patients in the multifocal group (Group A) and 40 eyes of 20 patients in the monofocal IOL group (Group B) were studied. Inclusion criteria for Group A (ReSTOR patients) included: age between 57 to 67 years with bilateral cataract and presbyopia. Otherwise, with healthy eyes and expressed a wish to be spectacle independent. They were also keen to be able to read without glasses after bilateral cataract surgery. All patients were counseled about the realistic expectation of the IOL and the potential drawbacks, plus they all signed the well-informed consent.

All patients had less than 1 diopter of preoperative corneal astigmatism. Preoperative assessment for all patients included manifest refraction, slit-lamp biomicroscopy, Goldman applanation tonometry, and binocular indirect ophthalmology. A biometry was performed using IOL Master Software Version 4.xx (Carl Zeiss Meditec, Jena, Germany) and keratometry was performed with NIDEK ARK-510A AUTO REF/KERATOMETER (NIDEK CO., LTD. Tokyo, Japan). It was aimed at the closest to +0.25 SD post operative refractive statuses for the ReSTOR patients, while routinely targeting emmetropia or slight myopia for the monofocal IOL. All patients were seen postoperatively at day one, in one week and in one month, then, three and six months post operatively. They also had post operative clinical evaluation that included uncorrected and corrected: far and near visual acuities, manifest

refraction, slit-lamp biomicroscopy and dilated fundus examination. Patients were checked for IOL position and posterior capsule condition using slit-lamp after pupil dilatation. No patient had significant IOL decentration or posterior capsular opacity resulting in visual symptoms. Ancillary testing (Optical Coherence Tomography -OCT- macula and fundus fluorescene angiography) was performed for patients with significant dissatisfaction of their vision. Second eye surgery was offered 2-3 weeks after the first eye operation in the ReSTOR Group A. This interim was not considered in the study for patients in the monofocal AcrySof SA60AT Group B. All patients in both groups had bilateral IOL implantation except for one patient in the multifocal group.

Surgical Technique

All surgeries were performed by the same surgeon and using standardized bimanual phacoemulsification with the Infiniti Vision System (Alcon). Under topical anesthesia with IV sedation, 2.8mm clear corneal incisions were made at locations based on reducing overall corneal astigmatism. Viscoelastic (Provisc) was used to deepen the A/C; anterior continuous curvilinear capsulorhexis measuring approximately 5.0 mm in diameter was accomplished by using a bent needle and capsulorhexis forceps. After hydrodissection, endocapsular phacoemulsification of the nucleus, an irrigation and aspiration of the residual cortex were carried out. The IOL was placed in the capsular bag using the Monarch II injector and C-cartridge (Alcon) or D-Cartilage. All surgeries were uneventful. All IOLs were implanted and well-centered within the capsular bag.

Intraocular Lenses Characteristics

The AcrySof ReSTOR SN60D3 multifocal intraocular lens is a yellow-tinted, foldable, single-piece, biconvex IOL made of a high-refractive index (1.55) hydrophobic, flexible cross linked acrylate-methacrylate copolymer with a chemically bonded ultraviolet chromophore[13]. This IOL combines the function of the apodized diffractive region. The apodized diffractive optics is within the central 3.6 mm optical zone of the IOL. This area comprises of 12 concentric steps of gradually (1.3 to 2μm) heights, creating bifocality from near to far (2 foci). The refractive region of the optic surrounds the apodized diffractive region. This area directs light to distant focal point for larger pupil diameter and is dedicated to distance vision. The overall diameter

of the IOL is 13.0 mm, and the optic diameter is 6.0 mm. The IOL power varies from +10.0 to +30.0 D and incorporates a +4.0 near addition (add) at the IOL plane, which corresponds to +3.2 add at the spectacle plane[14]. This hybrid diffractive-refractive concept has been shown to result good and stable visual outcomes after cataract extraction. The monofocal AcrySof SA60AT is a yellow-tinted, foldable, single piece, and anterior asymmetric biconvex and had a 6.0 mm acrylic optic. The single-piece design and acrylic material are the same as those of the ReSTOR multifocal IOL.

Six months post operative uncorrected (UC) and best corrected, distance and near visual acuity results and a manifest refraction spherical error (MRSE) were obtained from the charts and served as primary outcome measures. Distance visual acuity was measured using the Snellen chart at 6 m and the near visual acuity was measured using the Jaeger chart at about 31 cm. MRSE was measured with NIDEK ARK-510A; antro-Refractor. Secondary outcome measures were spectacle dependency, visual phenomena and overall patient satisfaction, and if they would have the procedure again. These were obtained as answers to physician direct questioning, or well self-reported by the patients themselves at any visit from 3-6 months post operatively.

Statistical analysis was performed with SPSS version 12.0 (SPSS, Chicago, ILL, USA). Results were expressed as means ± SD. The (paired-sample *t*-test) was used to compare visual acuities and refractive outcomes between groups. Categorical variables were compared using the (chi-square test). A p value set at or less than 0.05 was considered statistically significant.

Results

Thirty-nine eyes of forty patients were reviewed (39 eyes / 20 patients in the multifocal group (Group A) and 40 eyes / 20 patients in the monofocal (Group B). Each group consisted of 9 males and 11 females. Only one patient had cataract extraction and ReSTOR IOL implantation in one eyes. Forty eyes of twenty patients implanted bilaterally, and uneventfully with AcrySof SA60AT, monofocal IOL served as the control group. The mean ± SD age was 61.8 (± 3.1) years for the multifocal group and 62.4 (± 2.166) years for the monofocal group. The control group was closely matched with the study group in terms of age, sex and preoperative eye condition (Table 1).

Table 1. Preoperative demographics and eye condition.

Characteristics	IOL Group		*P* Value
	Multifocal A	Monofocal B	
Number, eyes/patients	39/20	40/20	-
Male/Female	9/11	9/11	> 0.05
Mean age (years) ± SD	61.8 ± 3.1	62.4 ± 2.16	> 0.05
Keratometry (D)			
Mean ± SD			
K1	44.36 ± 1.34	44.21 ± 1.51	> 0.05
K2	43.55 ± 1.54	43.30 ± 1.74	
IOL power (D)			
Mean ± SD	21.70 ± 2.19	20.80 ± 3.60	> 0.05
Range (D)	18 to 24	18 to 25	

IOL = Intraocular lens; SD = Standard deviation; D = Diopter

Preoperatively, all patients had uncorrected distance acuity of 0.5 *P*-value or better. Uncorrected distance acuity of 0.7 or better was achieved in 87.2% eyes in the multifocal group and 90.0% in the monofocal group and of 0.8 or better, in 74.4% and 70.0%, respectively. Best corrected distance acuity of 0.8 or better was achieved in all eyes in both groups and of 0.9-1.0 in about 95.0% in both groups. The mean postoperative spherical error was + 0.30 diopter in the multifocal group and - 0.14 diopter in the monofocal group.

A significantly greater proportion of eyes in the multifocal group (60.0%) compared to in the monofocal group (2.5%) achieved an uncorrected near acuity (UCDVA) of 0.7 (J2, N5) or better. 95.0% of eyes in the multifocal group and 17.5% in the monofocal group achieved an uncorrected near visual acuity (UCNVA) of 0.5 (J3, N6) or better. Best corrected near visual acuity (BCNVA), which was achieved by correcting the eyes for distance, and then putting the near add for the reading distance. Thus, there was not significantly different between the two groups.

In both groups (multifocal Group A and monofocal Group B), there was comparable high level of satisfaction with the overall vision postoperatively indicating that the cataract surgery was successful. Furthermore, the uncorrected visual acuity noticeably improved from its pre-surgical state. With bilateral multifocal IOL implantation, rates of spectacle dependency were reported to be significantly lower than with monofocal IOLs[15-17]. No patient in the multifocal group wore glasses all the time. However, reading glasses were required in 15% of the

patients in the multifocal group and 95% in the monofocal group. Moderate symptoms were reported in 20.0% of eyes in the multifocal group and 5% in the monofocal group (P=.008). One patient in the multifocal group, however, reported "significant and bothering" but still not incapacitating, the glare and halos. The same patient was more dissatisfied because she could not perform fine handwork jobs without glasses. The patient was a nurse who wanted to see without glasses 10/0 vicryl needle, thus, refused to have the same type of IOL in her other eye.

No patient reported severe glare in the monofocal group. Moreover, no patient in the monofocal group was dissatisfied enough to request IOL removal or discontinue with the other eye surgery. Previous studies report a significantly higher rate of photic phenomenon (especially halos and glare) with multifocal IOLs[7,10-11,19].

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. 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[1,2]. Table 2 and 3 show the individual visual acuity results and spherical error for the multifocal IOL Group A and monofocal IOL Group B, respectively. Tables 4-6 show mean visual acuities for distance and near, and mean spherical error for the two groups with the statistical significance indicated by the p value (< 0.05).

Table 2. Six-month postoperative visual acuities and spherical error results in patients with multifocal intraocular lens.

Multifocal Group A Eyes	UCDVA	BCDVA	UCNVA	BCNVA	SE
1.Right	0.7	0.9	0.7	0.9	-0.25
Left	0.8	0.9	0.7	0.9	0.00
2.	0.8	0.9	0.8	0.8	+0.25
	0.9	1.0	0.8	0.8	+0.25
3.	0.9	1.0	0.6	0.7	0.00
	0.9	1.0	0.6	0.7	0.00

Table 2. ***(Continuation)*** **Six-month postoperative visual acuities and spherical error results in patients with multifocal intraocular lens.**

Multifocal Group A Eyes	UCDVA	BCDVA	UCNVA	BCNVA	SE
4.	0.6	0.9	0.7	0.7	-0.25
	0.8	0.9	0.7	0.7	+0.25
5.	0.9	0.9	0.7	0.7	+0.25
	0.9	0.9	0.7	0.7	+0.50
6.	0.6	0.9	0.8	1.0	+1.00
	0.7	0.9	0.8	1.0	+0.50
7.	0.6	0.8	0.8	0.9	+0.75
	0.6	0.8	0.8	0.9	+0.75
8.	0.8	0.9	0.5	0.6	+0.25
	0.8	0.9	0.4	0.6	+0.50
9.	0.8	0.9	0.6	0.7	+0.25
	0.9	0.9	0.7	0.7	+0.25
10.	0.8	0.9	0.6	0.7	+0.25
	0.8	0.9	0.6	0.7	+0.25
11.	0.9	0.9	0.7	0.8	+0.25
	0.9	0.9	0.7	0.8	+0.25
12.	0.8	0.9	0.6	0.7	+0.25
	0.8	0.9	0.6	0.7	+0.25
13.	0.8	0.9	0.7	0.7	+0.25
	1.0	1.0	0.7	0.7	+0.25
14.	0.9	1.0	0.6	0.7	+0.25
	0.9	1.0	0.6	0.7	+0.25
15.	0.8	0.9	0.7	0.8	+0.25
	0.8	0.9	0.7	0.8	+0.25
16.	0.7	1.0	0.6	0.7	+0.50
	0.8	1.0	0.6	0.7	+0.50
17.	0.8	1.0	0.7	0.8	+0.25
	0.8	1.0	0.7	0.8	+0.25
18.	0.6	0.9	0.5	0.5	+0.75
	0.7	0.9	0.5	0.5	+0.50
19.	0.8	1.0	0.7	0.8	+0.25
	0.8	1.0	0.7	0.8	+0.25
20.	0.7	0.9	0.4	0.7	+1.25

UCDVA = Uncorrected distance visual acuity; BCDVA = Best corrected distance visual acuity;
UCNVA = Uncorrected near visual acuity; BCNVA = Best corrected near visual acuity;
SE = Spherical error

Table 3. Six-month postoperative visual acuities and spherical error results in patients with monofocal intraocular lens.

Monofocal Group B Eyes	UCDVA	BCDVA	UCNVA	BCNVA	SE
1. Right	0.7	0.9	0.5	1.0	-0.50
Left	0.7	0.9	0.5	1.0	-0.50
2.	0.9	1.0	0.4	0.9	-0.25
	0.9	1.0	0.4	0.9	-0.25

Table 3. ***(Continuation)*** **Six-month postoperative visual acuities and spherical error results in patients with monofocal intraocular lens.**

Monofocal Group B Eyes	UCDVA	BCDVA	UCNVA	BCNVA	SE
3.	0.9 0.9	1.0 1.0	0.3 0.4	0.8 0.8	-0.25 -0.50
4.	0.6 0.8	0.9 0.9	0.4 0.3	0.7 0.7	-0.25 +0.25
5.	1.0 0.9	1.0 1.0	0.3 0.3	0.7 0.7	+0.25 +0.50
6.	0.5 0.7	0.9 0.9	0.2 0.3	0.8 0.8	+1.00 +0.50
7.	0.5 0.7	0.8 0.8	0.2 0.3	0.8 0.8	+0.75 +0.25
8.	0.8 0.8	0.9 0.9	0.5 0.4	0.6 0.6	-0.25 -0.50
9.	0.9 0.9	1.0 1.0	0.3 0.3	0.8 0.8	+0.25 +0.25
10.	0.8 0.9	0.9 0.9	0.4 0.3	0.7 0.7	-0.25 0.00
11.	0.8 0.7	0.9 0.9	0.4 0.4	0.8 0.8	-0.25 -0.50
12.	0.8 0.8	0.9 0.9	0.3 0.3	0.7 0.7	-0.25 -0.25
13.	0.8 1.0	1.0 1.0	0.4 0.3	0.9 0.9	-0.50 0.00
14.	1.0 1.0	1.0 1.0	0.3 0.3	0.9 0.9	0.00 0.00
15.	0.8 0.8	1.0 1.0	0.4 0.4	0.8 0.8	-0.25 -0.25
16.	0.7 0.8	1.0 1.0	0.7 0.5	0.8 0.8	-1.00 -0.50
17.	0.8 0.8	0.9 0.9	0.3 0.4	0.6 0.6	+0.25 -0.25
18.	0.6 0.7	0.9 0.9	0.5 0.5	0.8 0.8	-0.75 -0.50
19.	0.8 0.8	1.0 1.0	0.4 0.4	0.8 0.8	-0.25 -0.25
20.	0.7 0.8	0.9 1.0	0.4 0.4	0.7 0.8	-0.25 -0.25

UCDVA = Uncorrected distance visual acuity; BCDVA = Best corrected distance visual acuity;
UCNVA = Uncorrected near visual acuity; BCNVA = Best corrected near visual acuity;
SE = Spherical error

Table 4. Six-month postoperative uncorrected and best corrected distance visual acuities.

Distance Visual Acuity	IOL Group		*P* Value
	Multifocal A	Monofocal B	
Uncorrected			
Mean ± SD	0.79 ± 0.10	0.79 ± 0.12	> 0.05
Range	0.6 - 1.0	0.5 - 1.0	
Best corrected			
Mean ± SD	0.92 ± 0.05	0.94 ± 0.05	> 0.05
Range	0.8 - 1.0	0.8 - 1.0	

IOL = Intraocular lens; SD = Standard deviation

Table 5. Six-month postoperative uncorrected and best corrected near visual acuities.

Near Visual Acuity	IOL Group		*P* Value
	Multifocal A	Monofocal B	
Uncorrected			
Mean ± SD	0.66 ± 0.10	0.37 ± 0.095	< 0.05
Range	0.4 - 0.8	0.2 - 0.7	
Best corrected			
Mean ± SD	0.75 ± 0.11	0.78 ± 0.099	> 0.05
Range	0.5 - 1.0	0.6 - 1.0	

IOL= Intraocular lens; SD= Standard deviation

Table 6. Six-month postoperative spherical error.

Result	IOL Group		*P* Value
	Multifocal A	Monofocal B	
Spherical error (D)			
Mean ± SD	0.30 ± 0.24	-0.14 ± 0.40	< 0.05
Range	-0.25 - 1.00	-1.0 - 1.0	

IOL = Intraocular lens; D = Diopter; SD = Standard deviation

Several published studies found that AcrySof ReSTOR IOLs provides good unaided distance and near visual acuities and afford high patient satisfaction in the specified follow up period[20-21]. Chiam *et al.*[15,18] reported spectacle dependency in 14% to 15% of patients, while Vingolo *et al.*[16] reported 8%. Others have found less satisfactory results with regard to visual disturbances, with evidence of marked increases in halos and glare after IOL implantation[7,15,22]. However, the present study found that uncorrected near acuity in the multifocal IOL group, 6 months postoperatively, was significantly better than that of the monofocal group. Whereas best corrected near visual acuity (BCNVA), uncorrected distance visual acuity (UCDVA) and best corrected distance visual acuity (BCDVA) were comparable in the 2 groups. This is similar to former

prospective studies comparing multifocal IOLs with monofocal IOLs[23-28].

Unexpectedly, spectacle dependency was significantly less in the multifocal IOL group compared to the control group. The difference in the mean spherical errors between the groups could be explained by the slightly different target postoperative refraction. In the multifocal group, the postoperative refraction was intended to be slightly hyperopic (+0.25 SD or closest to it) to produce the best possible visual outcome with this type of IOL. In the monofocal group, the post-operative refraction was targeted to be emmetropic or slightly myopic. There were more subjects who achieved distance vision (whether uncorrected or best corrected) of 20/20 in the monofocal group compared to the multifocal group. This observation was also found in a meta–analytical systematic review by Leyland and Zinicola comparing diffractive multifocal IOLs and monofocal IOLs, which showed statistically significant more eyes with 20/20 or better (best distance corrected) in the monofocal group[1]. Our study found statistically significant more visual symptoms in patients implanted with the multifocal IOL. This was also reported in other studies of different multifocal IOLs[7,10,11,15,19,22,28,29]. This study also established that there is high level of satisfaction despite most patients' experience of various degrees of photic visual phenomena. 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[6,25,30]. None of our patients who experienced visual symptoms was willing to exchange the AcrySof ReSTOR 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[31]. 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.

In conclusion, bilateral ReSTOR IOL implantation is effective in achieving good unaided near and distance vision, provided certain conditions are met. Proper patient selection is required, among other parameters; habitual visual tasks, interest in being spectacle independent, realistic expectations, preoperative eye condition and corneal astigmatism[32]. The multifocal IOL provides better uncorrected near

visual acuity and greater spectacle independence than the monofocal IOL. In addition to visual acuities at different distances, visual phenomena and quality of overall vision are important to determinant an overall subjective satisfaction.

References

[1] **Leyland M, Zinicola E.** Multifocal versus monofocal intraocular lenses in cataract surgery: a systematic review. *Ophthalmology* 2003; **110**(9): 1789-1798.

[2] **Leyland MD, Langan L, Goolfee F, Lee N, Bloom PA.** Prospective randomised double-masked trial of bilateral multifocal, bifocal or monofocal intraocular lenses. *Eye* 2002; **16**(4): 481-490.

[3] **Bellucci R.** Multifocal intraocular lenses. *Curr Opin Ophthalmol* 2005; **16**(1): 33-37.

[4] **Cionni, RJ, Osher RH, Synder ME, Nordlund ML.** Visual outcome comparison of unilateral versus bilateral implantation of apodized diffractive multifocal intraocular lenses after cataract extraction: prospective 6-month study. *J Cataract Refract Surg* 2009; **35**(6): 1033-1039.

[5] **Javitt JC, Wang F, Trentacost DJ, Rowe M, Tarantino N.** Outcomes of cataract extraction with multifocal intraocular lens implantation: functional status and quality of life. *Ophthalmology* 1997; **104**(4): 589-599.

[6] **Javitt JC, Steinert RF.** Cataract extraction with multifocal intraocular lens implantation: a multinational clinical trial evaluating clinical, functional, and quality-of-life outcomes. *Ophthalmology* 2000; **107**(11): 2040-2048.

[7] **Souza CE, Muccioli C, Soriano ES, Chalita MR, Oliveira F, Freitas LL, Meire LP, Tamaki C, Belfort R Jr.** Visual performance of AcrySof ReSTOR apodized diffractive IOL: a prospective comparative trial. *Am J Ophthalmol* 2006; **141**(5): 827-832.

[8] **Simpson MJ.** The diffractive multifocal intraocular lens. *Eur J Implant Refract Surg* 1989; **1**: 115-121.

[9] **Blaylock JF, Si Z, Aitchison S, Prescott C.** Visual function and change in quality of life after bilateral refractive lens exchange with the ReSTOR multifocal intraocular lens. *J Refract Surg* 2008; **24**(3): 265-273.

[10] **Steinert RF, Aker BL, Trentacost DJ, Smith PJ, Tarantino N.** A prospective comparative study of the AMO ARRAY zonal-progressive multifocal silicone intraocular lens and a monofocal intraocular lens. *Ophthalmology* 1999; **106**(7): 1243-125.

[11] **Jacobi PC, Dietlein TS, Lüke C, Jacobi FK.** Multifocal intraocular lens implantation in prepresbyopic patients with unilateral cataract. *Ophthalmology* 2002; **109**(4): 680-686.

[12] **Holliday, JT, Van Dijk H, Portney V, Willis TR, Sun R, Oksman HC.** Optical performance of multifocal intraocular lenses. *J Cataract Refract Surg* 1990; **16**(4): 413-422.

[13] **AcrySof ReSTOR**. *Physician Labeling*. Rev. I. Forth Worth (TX): Alcon Laboratories; 2004.

[14] **Davison JA, Simpson MJ.** History and development of the apodized diffractive intraocular lens. *J Cataract Refract Surg* 2006; **32**(5): 849-858.

[15] **Chiam PJ, Chan JH, Aggarwal RK, Kasaby S.** ReSTOR intraocular lens implantation in cataract surgery: quality of vision. *J Cataract Refract Surg* 2006; **32**(9): 1459-1463.

[16] **Vingolo EM, Grenga P, Iacobelli L, Grenga R.** Visual acuity and contract sensitivity: AcrySof ReSTOR apodized diffractive versus AcrySof SA60AT monofocal intraocular lenses. *J Cataract Refract Surg* 2007; **33**(7): 1244-1247.

[17] **Lehmann R, Waycaster C, Hileman K.** A comparison of patient-reported outcomes from an apodized diffractive intraocular lens and a conventional monofocal intraocular lens. *Curr Med Res Opin* 2006; **22**(12): 2591-2602.

[18] **Chiam PJ, Chan JH, Haider SI, Karia N, Kasaby H, Aggarwal RK.** Functional vision with bilateral ReZoom and ReSTOR intraocular lenses 6 months after cataract surgery. *J Cataract Refract Surg* 2007; **33**(12): 2057-2061.

[19] **Cillino S, Casuccio A, Di Pace F, Morreale R, Pillitteri F, Cillino G, Lodato G.** One-year outcomes with new-generation multifocal intraocular lenses. *Ophthalmology* 2008; **115**(9): 1508-1516.

[20] **Alfonso JF, Fernández-Vega L, Baamonde MB, Montés-Micó R.** Prospective visual evaluation of apodized diffractive intraocular lenses. *J Cataract Refract Surg* 2007; **33**(7): 1235-1243.

[21] **Alfonso JF, Fernández-Vega L, Baamonde MB, Montés-Micó R.** Correlation of pupil size with visual acuity and contrast sensitivity after implantation of an apodized diffractive intraocular lens. *J Cataract Refract Surg* 2007; **33**(3): 430-438.

[22] **Souza CE, Gerente VM, Chalita MR, Soriano ES, Freitas LL, Belfort R Jr.** Visual acuity, contrast sensitivity, reading speed, and wavefront analysis: pseudophakic eye with multifocal IOL (ReSTOR) versus fellow phakic eye in non-presbyopic patients. *J Refract Surg* 2006; **22**(3): 303-305.

[23] **Hayashi K, Masumoto M, Hayashi H.** All-distance visual acuity in eyes with a nontinted or a yellow-tinted diffractive multifocal intraocular lens. *Jpn J Ophthalmol* 2009; **53**(1): 100-106.

[24] **el-Maghraby A, Marzouky A, Gazayerli E, Van der Karr M, DeLuca M.** Multifocal versus monofocal intraocular lenses. Visual and refractive comparisons. *J Cataract Refract Surg* 1992; **18**(2): 147-152.

[25] **Allen ED, Burton RL, Webber SK, Haaskjold E, Sandvig K, Jyrkkiö H, Leite E, Nyström A, Wollensak J.** Comparison of a diffractive bifocal and a monofocal intraocular lens. *J Cataract Refract Surg* 1996; **22**(4): 446-451.

[26] **Blaylock JF, Si Z, Vickers C.** Visual and refractive status at different focal distances after implantation of the ReSTOR multifocal intraocular lens. *J Cataract Refract Surg* 2006; **32**(9): 1464-1473.

[27] **Bi H, Cui Y, Ma X, Cai W, Wang G, Ji P, Xie X.** Early clinical evaluation of AcrySof ReSTOR multifocal intraocular lens for treatment of cataract. *Ophthalmologica* 2008; **222**(1): 11-16.

[28] **Zhao G, Zhang J, Zhou Y, Hu L, Che C, Jiang N.** Visual function after monocular implantation of apodized diffractive multifocal or single-piece monofocal intraocular lens: Randomized prospective comparison. *J Cataract Refract Surg* 2010; **36**(2): 282-285.

[29] **Hofmann T, Zuberbuhler B, Cervino A, Montés-Micó R, Haefliger, E.** Retinal straylight and complaint scores 18 months after implantation of the AcroSof monofocal and ReSTOR diffractive intraocular lenses. *J Refract Surg* 2009; **25**(6): 485-492.

[30] **Percival SP, Setty SS.** Prospectively randomized trial comparing the pseudo accommodation of the AMO ARRAY multifocal lens and a monofocal lens. *J Cataract Refract Surg* 1993; **19**(1): 26-31.

[31] **Kaymak H, Fahle M, Ott G, Mester U.** Intraindividual comparison of the effect of training on visual performance with ReSTOR and Tecnis diffractive multifocal IOLs. *J Refract Surg* 2008; **24**(3): 287-293.

[32] **Ravalico G, Parentin F, Baccara F.** Effect of astigmatism on multifocal intraocular lenses. *J Cataract Refract Surg* 1999; **25**(6): 804-807.

العدسات ذات الأبعاد البؤرية المختلفة والعدسات ذات البعد الواحد، دراسة مقارنة لقوة الإبصار والاحتياج للنظارة ورضا المرضى

سعد عبدالله وهيب

قسم العيون، كلية الطب، جامعة الملك عبدالعزيز

مستشفى الملك فيصل التخصصي ومركز الأبحاث

جدة – المملكة العربية السعودية

المستخلص. قمنا بدراسة مقارنة النتائج والحاجة للنظارة ورضا المرضى بعد عمليات سحب الماء الأبيض وزراعة العدسات ذات الأبعاد البؤرية المختلفة داخل العين مع زراعة العدسات العادية ذات البعد الواحد – حيث تمكن العدسات ذات الأبعاد المختلفة المرضى من رؤية القريب والبعيد في آن واحد. وقد تبين من الدراسة أن العدسات ذات الأبعاد المختلفة هي الأفضل من حيث النظر القريب والبعيد وعدم الحاجة للنظارة بعد العمليات.