DOI 10.5935/0034-7280.20200002

Clinical experience after tetrafocal intraocular lens implantation "PANOPTIX"

Experiência clínica após implantação de lentes intraoculares tetrafocais "PANOPTIX"

Miguel Ángel Ibáñez-Hernández[1] https://orcid.org/0000-0003-4337-1349
Ricardo Acosta-González[1] https://orcid.org/0000-0002-6049-7325
Mariana Mayorquín-Ruiz[2] https://orcid.org/0000-0002-5027-5550
Ángel Garcia-Vasquez[3] https://orcid.org/0000-0003-1689-2931
Gabriela Estefania Ibarra-Elizalde[2] https://orcid.org/0000-0002-9548-9413

ABSTRACT

Purpose: *To assess long, intermediate and near uncorrected visual acuity after a tetrafocal diffractive intraocular lens implantation, presence of dystopic phenomenon and patient satisfaction after surgery.* ***Methods:*** *Retrospective, observational study performed in Puerta de Hierro Specialties Hospital, in Jalisco, México. That included 100 eyes after phacoemulsification surgery by femtosecond assistance, followed by tetrafocal diffractive intraocular lens implantation due to cataract. Long, intermediate and near visual acuity without correction was measured, and presence or absence of dystopic phenomenon, plus patient satisfaction after surgery.* ***Results:*** *A total of 100 eyes in 50 patients who underwent cataract surgery with phacoemulsification by femtosecond assistance were evaluated. 100% underwent bilateral phacoemulsification. Long, intermediate, and near visual acuity after three months was in the most patients 20/20 (46%), 20/15 (44%) and Jaeger 1 (48%) respectively. The percentage or patients who refers halos was 7%; and other associated symptoms in 18%, being astenopia the most prevalent. The removal of the lens was not required in any case.* ***Conclusion:*** *Tetrafocal diffractive intraocular lenses provides excellent intermediate vision (at 60 centimeters) and satisfactory near (30 centimeters) and long (6 meters) visual acuity.*

Keywords: *Lenses, intraocular; Visual acuity; Cataract; Presbyopia*

RESUMO

Objetivo: Avaliar a acuidade visual de longe, intermediária e de perto após o implante de lente intra-ocular difrativa tetrafocal, presença de fenômenos distópicos e satisfação do paciente após a cirurgia. **Métodos:** Estudo retrospectivo, observacional, realizado em Puerta de Hierro Hospital de Especialidades, em Jalisco, México. Isso incluiu 100 olhos após a cirurgia de facoemulsificação pela presença de laser de femtosegundo, seguida por implante de lente intra-ocular difrativa tetrafocal devido à catarata ou cirurgia facorrefractiva. Foi medida a acuidade visual de longe, intermediária e de perto, e a presença ou ausência de fenômenos distópicos, além da satisfação do paciente após a cirurgia. **Resultados:** Um total de 100 olhos em 50 pacientes submetidos à cirurgia de catarata com facoemulsificação por femtosegundo foram avaliados. 100% foram submetidos a facoemulsificação bilateral. A acuidade visual para longe, intermediária e de perto após três meses foi na maioria dos pacientes 20/20 (46%), 20/15 (44%) e Jaeger 1 (48%) respectivamente. A porcentagem ou pacientes que se referem a halos foi de 7%; e outros sintomas associados em 18%, sendo a astenopia a mais prevalente. A remoção da lente não foi necessária em nenhum caso. **Conclusão:** A lente intra-ocular difrativa tetrafocal fornece excelente visão intermediária (a 60 centímetros) e acuidade visual satisfatória de perto a (30 centímetros) e de longe (6 metros).

Descritores: Lentes intraoculares; Acuidade visual; Catarata; Presbiopia

[1] Ophthalmology Center, Puerta de Hierro Medical Center, Zapopan, Jalisco, México.
[2] Ocular Ultrasonography Department, Asociación para Evitar la Ceguera en México, I.A.P., Mexico City, México.
[3] Mexican Social Security Institute; México.

The authors declare no conflicts of interests.
Received for publication 12/12/2018 - Accepted for publication 14/11/2019.

Introduction

Emmetropia is one of the objectives of modern cataract surgery.[1]

The ideal intraocular lens (IOL) would be the one that restores the visual acuity (VA) of the patient, without visual compromise or complications, giving the patient the ability to see at all distances.[2]

To undertake a visual task in a range of near vision, the eye must be able to focus the light rays at distances closer than infinity. In young patients, this process is carried out with an increase in curvature and therefore in the power of the lens. However, this capacity of accommodation gradually decreases with aging, and leads to presbyopia around 40-45 years of age.[3]

Thus, the placement of an IOL represents the method of choice for many surgeons, as an option to provide patients with adequate VA (without glasses dependence) over a range of determined distances.[3]

The optic of the multifocal intraocular lenses, is designed to provide a functional vision in both distances, near and far, by creating two images in the retina, this phenomenon was granted the term of "Simultaneous Vision". However, the resulting visual phenomenon is associated with the reduction of contrast sensitivity, resulting from the division of light between two or more images.[3]

In a diffractive lens, the rings on the surface form a discontinuity in the optical density that generates diffraction of light in order to form two images focused on the retina, for two particular distances (far and near), that is, bifocality. In turn, a refractive lens is capable of forming two or more images in the retina, as a result of the density difference in the optics of the lens, associated in turn with changes in the curvature of the surface, thus many refractive designs include continuous changes between zones and effectively in two or more optical zones to focus light at several distances (multifocality), with the potential ability to provide functional vision regardless of distance.[3]

Among the innovations included in intraocular lenses are the hybrid diffractive-refractive lenses, designed to increase the functional range of vision; aspherical surfaces to minimize spherical aberrations; and asymmetric intraocular lenses with smooth transitions between near and far vision zones to maximize sensitivity to constrict.[3]

It is becoming increasingly acceptable to perform primary procedures in early patients with presbyopia between 40 and 50 years, due to: 1) The corrective limits of the excimer laser to treat high refractive disorders and 2) The growing demand of patients to be independent of using glasses.[3]

Based on multifocality technology, this study includes a total of 100 eyes, subjected to bilateral cataract or refractive surgery with phacoemulsification technique, femtosecond-assisted, and capsular bag implantation of a diffractive IOL, in order to evaluate the visual results, in this way, VA was compared, obtained at near, intermediate and far distance.

Methods

Retrospective and observational study. A total of 100 eyes of 50 patients were included, submitted to cataract surgery or binocular phaco refractive surgery, performed with femtosecond-assisted phacoemulsification technique (LensX® system, Alcon), after that, a diffractive tetrafocal intraocular lens was implanted, in all cases being the AcrySof multifocal lens IQ Panoptix.

Surgical patients were included during the period of time between May and December 2016 in the ophthalmology service of a Specialties Center in Jalisco, México.

Inclusion criteria

Patients older than 42 years old with diagnosis of cataract and or lens dysfunction demonstrated by densitometry, and corneal astigmatism less than 0.75 diopters (DP) .

Exclusion criteria

In order to reduce the bias in the VA results obtained after intraocular lens implantation, were excluded patients with corneal degeneration (including keratoconus, corneal ectasia), irregular corneal astigmatism, astigmatism greater than 0.75 DP, retinopathies (including diabetic retinopathy, and maculopathies), as well as those with a prior clinical history of uveitis, ocular trauma, intraocular inflammation, and glaucoma.

Characteristics of the lens

A diffractive tetrafocal hydrophobic lens with enlighten optical technology was implanted, this lens was designed for intracapsular placement; AcrySof IQ Panoptix ® is a one-piece lens, with aspherical optics of 6 mm in diameter, whose diffractive zone is 4.5 mm, the total diameter of the lens is 13 millimeters (mm), with a haptic angle of 0°, refractive index of 1.55 and constant of 119.1.

Pre-surgical assessment

The preoperative evaluation included a complete ophthalmologic examination. With recording of VA in far distance with Snellen chart at 6 meters; intermediate distance, at 60 cm; and near to 40 cm. As well as objective and subjective refraction, biomicroscopy of the anterior segment, tonometry by applanation, and indirect fundoscopy in slit lamp.

The biometry and calculation of intraocular lens power was performed with the IOL 700 Master platform (Carl Zeiss Meditec, Germany) and with a Lenstar LS900 equipment, using Barret's , SRK / T or Haigis formula according to the anteroposterior axis of each eye. The power of the intraocular lens was calculated based on parameters of emmetropia.

Surgical technique

All procedures were performed by two surgeons with extensive experience in phacoemulsification technique (M. A. I.H.) (R.A.G).

After topical anesthesia with tetracaine 5 mg / ml, and pharmacologically induced mydriasis with Tropicamide / Phenylephrine 8 mg / 50mg / ml (3 drops), crystalline extraction was performed with femtosecond assisted phacoemulsification technique with LenSx® platform (Alcon), and centered of the optical axis of the intraocular lens through the VERION ® system (Alcon). All procedures included the intraocular lens implant in capsular bag, without trans surgical complications.

Postoperative assessment

The patients were evaluated 24 hours after procedure within the immediate postoperative period, later at 7, 30 and 90 days.

After 24 hours of the surgical event, topical quinolone eye drops of fourth generation plus corticoid were started for 10 days to two weeks.

We questioned in a targeted manner about the presence or absence of photic phenomenon (classified as halos and glare), as well as the absence or presence of ocular symptoms (blurred vision, dry eye, and asthenopia).

Statistical analysis

The statistical analysis was performed with the software

SPSS 16.0 version for Windows. The Kolmogorov-Smirnov test was used to check the normality of the data distribution.

Results

The protocol included a total of 100 eyes of 50 patients, in an age range of 42 to 79 years, with an average of 58 years. We included 42 female patients (84%) and 8 male patients (16%). All patients underwent bilateral surgery.

Pre-surgical diagnosis.

Ten patients were operated with a cataract diagnosis (20%) and 40 patients underwent phaco refractive surgery with presbyopia diagnosis (80%). (Figure 1).

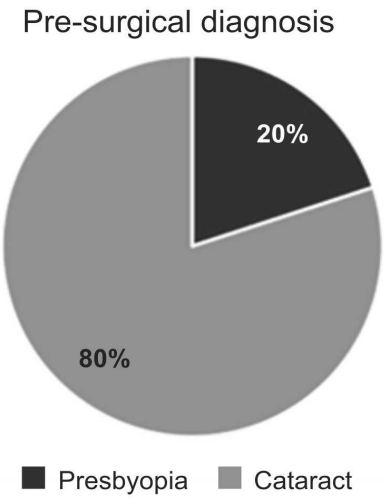


Figure 1: Percentage of patients with pre-surgical diagnosis of cataract and presbyopia.

Pre-operative visual acuity

20% of the patients had a preoperative VA of 20/100, 19% of 20/40 and the rest of the patients had a pre-surgical VA that ranged in the range of 20/20 to 20/400 (Figure 2). With an average of 20/80, in turn, the average near preoperative VA was 20/80 (Jaeger 8).

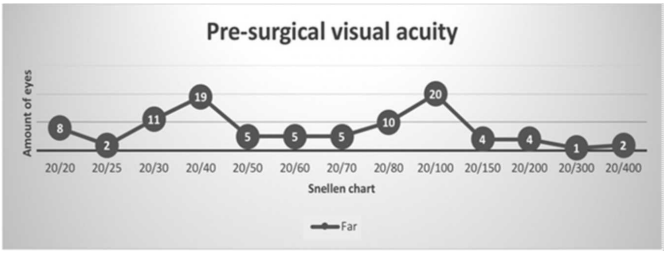
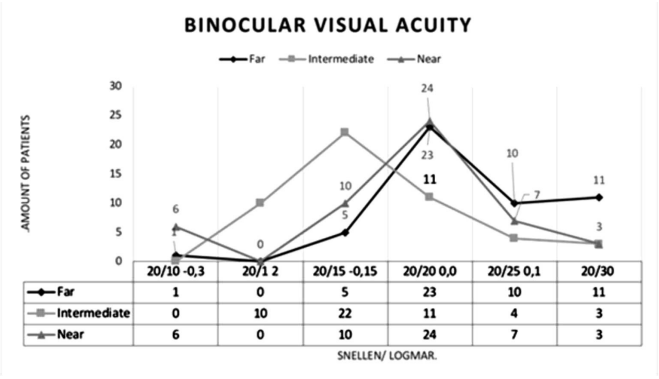


Figure 2: Distribution of preoperative visual acuity.

Visual acuity and postoperative refraction

A far, intermediate and near VA of 20/30 or better was obtained in 100% of the cases; the highest percentage of patients presented a near VA to 20/20 in (48%), 20/15 in intermediate vision (44%), and 20/20 in far vision (46%).

The final VA obtained at near distance (40cm), intermediate (60cm) and far (6 meters) is shown in Figure 3 and Figure 3.1.



	20/10 -0,3	20/1 2	20/15 -0,15	20/20 0,0	20/25 0,1	20/30
Far	1	0	5	23	10	11
Intermediate	0	10	22	11	4	3
Near	6	0	10	24	7	3

Figure 3: Distribution of postoperative visual acuity in distant, intermediate and near distances.

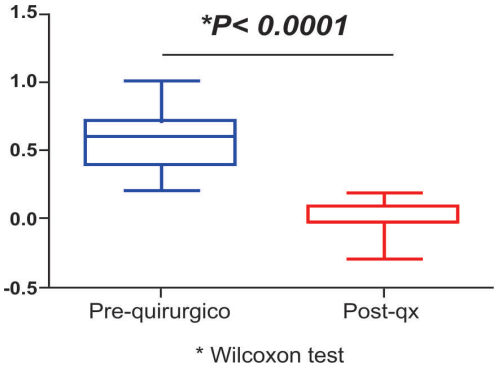


Figure 3.1: Comparative visual acuity before and after surgery.

Postoperative refraction

Through objective refraction, a sphere was found within the range of -0.50 to +0.50 diopters (DP) with an average of 0.30 DP; where 19 eyes obtained a neutral sphere (19%); 38 eyes a sphere within the range 0 to -0.25 DP (38%); and 43 eyes, within the range 0 to +0.50 (43%). (Figure 4)

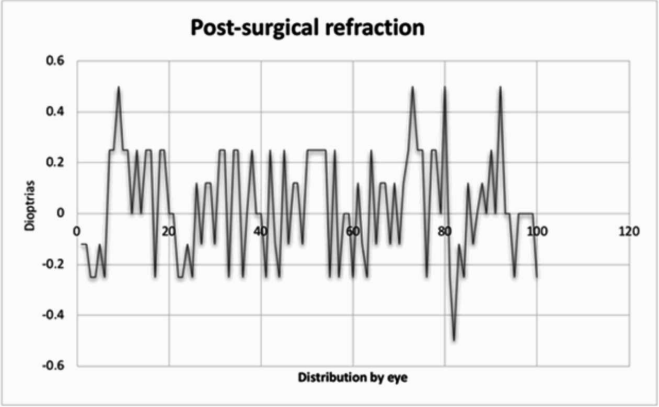


Figure 4: Distribution of postoperative refraction.

Residual spherical equivalent

Figure 5 shows the percentage of eyes with their respective residual spherical equivalent, being from -0.24 to 0.00 DP for most eyes (45%), followed by 0.01 to 0.25 DP in 38%, 0.26-0.50

DP in 10% of patients and from -0.25 to -0.50 DP in 7% of cases. With a range of ± 0.50 DP.

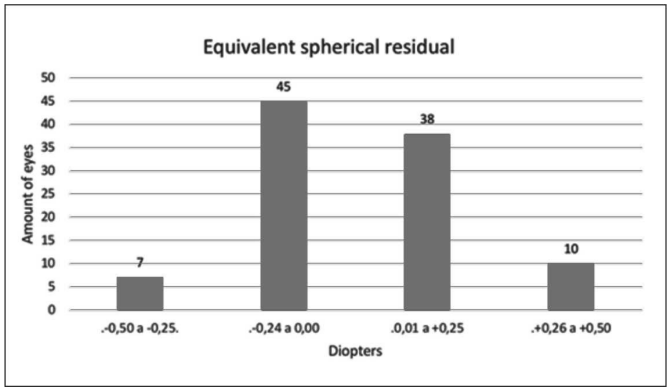


Figure 5: Distribution of residual spherical equivalents (S.E.).

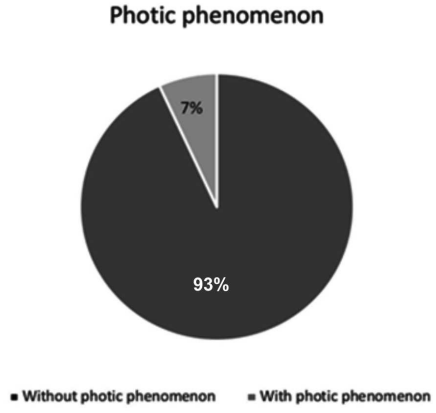


Figure 6: Distribution of patients with presence and absence of postoperative photic phenomenon.

Evaluation of Postoperative Symptoms

Upon direct interview, 9 patients reported ocular symptoms (18%), of this percentage of patients, 4 reported asthenopia (8%), 3 ocular dryness (6%) and 2 blurred vision (4%), thus being the most prevalent symptom asthenopia in 44.44% of the patients who presented symptoms. 82% of the total patients operated did not show associated symptoms. (Figure 7).

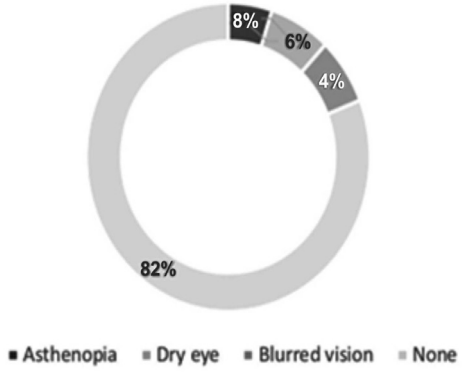


Figure 7: Distribution of postoperative ocular symptoms.

Outline of Defocus Curve shown in Figure 8.

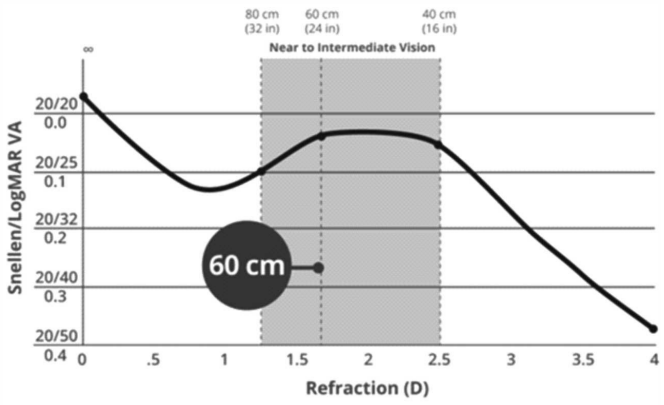


Figure 8: Defocusing curve.

Complications

99% of the patients did not present trans ssurgical or postoperative complications, in one patient cortical remains were present during the immediate postoperative period in the left eye, which was extracted in a second intervention without complications, with a final VA far of 20/20; intermediate, 20/15; and near of 20/25 at 60 days after the late postoperative period.

Discussion

The multifocal intraocular lenses are currently one of the most effective means to provide good VA in near, intermediate and far distance regardless of glasses.[1]

In our experience after the implantation of the intraocular lens Acrysof IQ Panoptix®, the percentage of patients who presented a VA of 20/25 or better was 58%, 86% and 80% for distant, intermediate and near vision respectively, which evidences the ability of the IOL to cover the vision needs at different distances.

Compared with previous reports, Emanuel Rosen et al. reported a distant monocular VA of 20/40 or better in 95.7% of the patients after the implantation of a multifocal lens. Likewise, the average of far VA from 20/20 or better after implantation of multifocal lenses was 58.1% in a total of 1810 eyes In the results of our study after the implantation of a tetrafocal multifocal IOL 100% of patients have a distant binocular VA better than 20/30 without correction; and 58% of the patients presented a VA of 20/20 or better at the same distance; the residual spherical equivalent in most of the eyes was -0.24 to 0.00 in this serie of cases (45%), with a general residual within the range of emmetropia in all patients, which denotes an adequate tolerance and a very satisfactory range of predictability and refractive stability.

There are previous reports of the average of uncorrected binocular vision in close vision of 20/40 or better in 99.9% of the patients (14 studies reviewed, in a total of 5359 patients) which coincides and is comparable with the evidence obtained in the present report, in which 100% of the patients obtained close VA better than 20/30; Likewise, the percentage of patients with distant VA of 20/20 or better was 79.2% in the analysis of 10 studies in which a total of 5140 patients were evaluated.[3] In the case of our report, this percentage is 58%, and the comparative table with the IOL implant reported in other series of cases with similar results is shown below. (Table 1).

Table 1
Comparative postoperative visual acuity between some intraocular lenses

Study	Intraocular lens name	Procedure	Visual acuity equal or better 20/40%	Far uncorrected visual acuity equal or better 20/20%
Chiam	Restor SA60D3	Cataract	100	53
Blaylock	Restor SA60D3	RLE/cataract	100	59.5
Gunenc	Array SA40N	Cataract	100	60
Bi	Restor	Cataract	97.2	60
Packer	Tecnis ZM900	_	100	57.9
Gierek-Ciaciura	ReZoom NXG1	Cataract	93.3	-
Yoshino	Tecnis ZM900	Cataract	93.3	-
Rabsilber	M-Flex (630F)	Cataract	100	-
Berrow	LENTIS Mplus X	RLE/Cataract	100	56
Venter	SBL-3	RLE	94.3	
Pepose	ReSTOR SN6AD1	Cataract	100	91
Alfonso	ReSTOR SND1T3, T4, T5	RLE/Cataract	93	57
Cillino	Tecnis ZMA00	Cataract	100	-
Venter	LENTIS Mplus	RLE/cataract	99.2	80.5
Current study	Panoptix	Cataract/RLE	100	58

Source: Rosen E, Alió JL, Dick HB, Dell S, Slade S. Efficacy and safety of multifocal intraocular lenses following cataract and refractive lens exchange: Metaanalysis of peer-reviewed publications. J Cataract Refract Surg. 2016;42(2):310-28.(3)
*RLE. Refractive lens exchange.

After the implantation of intraocular lenses the visual symptoms most commonly reported according to the review reported in the meta-analysis of Emanuel Rosen et al., are halos and nocturnal glare, followed by dysphotopsias (positive and negative), shadows and wax vision. [3]

It has already been stipulated that postoperative VA does not guarantee patient satisfaction. The range of discomfort after IOL implantation varies from 0-14.3%, with no difference between refractive lens extraction and cataract extraction.[3] In a study published by Venter et al, in 9366 eyes, only 0.44% required IOL extraction due to side effects associated with it is necessary.[3]

In this context, the lack of satisfaction after IOL implantation has been predominantly associated with blurred vision or photic phenomenon, as well as opacity of the posterior capsule, pupillary size, and dry eye. A high incidence of photic phenomenon has been reported after the implantation of multifocal IOLs, with nocturnal visual symptoms.[3] There is also evidence that diffractive designs affect contrast sensitivity less than concentric refractive designs.[3]

In contrast, some meta-analysis have described the higher incidence of halos after implantation of diffractive IOLs, with a similar incidence of glare. A 2012 Cochrane review reports an incidence of 48.5% halos / glare in 395 patients studied after multifocal IOL implantation, compared with 25% of 304 patients with monofocal IOL.[3] The results of our study show a low incidence of photic phenomenon, being for this serie 7% (3 patients who manifested perception of halos); and 18% (9 patients) who reported associated symptoms after surgery, being in most cases asthenopia in 44.44% (4 of 9 patients), followed by ocular dryness in 3 patients.

In terms of the independence of glasses, an average of 80.1% with multifocal lenses. This independence is referred to the VA without glasses, both near and far. In relation to this analysis, 63 studies report the independence of glasses after the implant of intraocular lens with a percentage of 80.1%. The total independence of glasses was reported in 5 studies, which included the implantation of diffractive multifocal lenses, mix and match technique, and trifocal diffractive lenses.[3] In our case, 58% of the patients had a far VA of 20/20, 100% an intermediate VA of 20/30 or better and 94% a near VA of Jaeger 1 or better, which allowed the independence of glasses for near and far vision in the same percentage of patients.

Based on medical evidence, the solution for presbyopia is the multifocal IOL implant.[3] Both procedures, extraction of dysfunctional crystalline lens and cataractous lens extraction result in high levels of uncorrected distant vision, close to 100% of patients obtain a far uncorrected VA from 20/40 or better, which has coincided in the before mentioned references and in our cases report.

As has been confirmed in the current series of cases, and in previous series, there is currently not multifocal IOL free of nocturnal visual phenomenon. However, the percentage of affected eyes with this symptomatology resulted acceptable in our study protocol (3 of 100 patients). It has already been reported that patients who experience photopic phenomenon have to be more tolerant to them after 6 months of surgery.[3]

A hypothesis to this phenomenon is the neuroadaptive process involved in the reduction of nocturnal phenomenon.[3] Based on this premise, it will be essential to follow up patients who in this series of cases presented halos perception, in order to assess the evolution of these phenomenon over time.

It should be pointed out that patients with refractive lens extraction tend to be younger with lower rates of postoperative satisfaction, and a higher incidence of halos and glare,[3] which were not included in this serie of cases.

Javitt et al. results are similar to those found in this analysis in which in any case was necessary to withdraw the IOL due to dissatisfaction, or to perform refractive procedures after the IOL was implanted, in order to improve the degree of patient satisfaction. The best range of near VA quantified with LogMar was 0.1 or better in 80% of the eyes studied. [4]

Conclusion

The result of this analysis allows us to establish that the implantation of a multifocal intraocular lens of the tetrafocal type is a good option for its placement after cataract surgery or removal of dysfunctional lens in patients over 42 years old, when the objective is to obtain good far and near VA; and excellent intermediate vision. Which should be individualized to each style of activities and needs of the patient.

The risk-benefit of implanting this intraocular lens is very acceptable, since most of the patients show high satisfaction after implantation, and the incidence of photic phenomenon reported in this serie was lower than the average incidence reported in other series.

References

1. Ferreira TB, Marques EF, Rodrigues A, Montés-Micó R. Visual and optical outcomes of a diffractive multifocal toric intraocular lens. J Cataract Refract Surg. 2013;39(7):1029-35.
2. Braga-Mele R, Chang D, Dewey S, Foster G, Henderson BA, Hill W, et al.; ASCRS Cataract Clinical Committee. Multifocal intraocular lenses: relative indications and contraindications for implantation. J Cataract Refract Surg. 2014;40(2):313–22.
3. Rosen E, Alió JL, Dick HB, Dell S, Slade S. Efficacy and safety of multifocal intraocular lenses following cataract and refractive lens exchange: Metaanalysis of peer-reviewed publications. J Cataract Refract Surg. 2016;42(2):310-28.
4. 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: 2040-2048.

Corresponding autor:
Dr. Gabriela Estefania Ibarra Elizalde.
Vicente García Torres Nº. 46, San Lucas Coyoacán, 04030, México City, México.
E-mail: estefaniaibarrae@gmail.com