

Visual outcomes of the diffractive multifocal intraocular lens - Zeiss AT Lisa 809M™

Avaliação do desempenho visual da lente intraocular difrativa multifocal - Zeiss AT Lisa 809M™

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ABSTRACT

Purpose: To evaluate the visual function of patients with bilateral implantation of multifocal diffractive IOL AT Lisa 809M™ by visual acuity with and without correction, contrast sensitivity curve, defocus curve and visual function questionnaire (39 VQF). **Methods:** Interventional clinical prospective study, which evaluated the results of 20 eyes of 10 patients who underwent phacoemulsification and IOL implantation between february and june 2012. **Results:** The average of residual postoperative ametropia was 0.05 ± 0.42 (-0.75 to +1.25 D) spherical diopters and -0.30 ± 0.42 (0 to -1.25 D) cylindrical diopters. In the mono and binocular defocus curve, the best visual acuity was obtained with 0.00 D of defocus (far VA). The second peak was obtained with -3.00 D (near vision at 33 cm) and among these peaks, it was observed a loss of visual performance with -2.00 D, which corresponds to intermediate vision at 50 cm. Contrast sensitivity was similar to those reported in the literature with this type of IOL, both with and without glare, and is shown in the figures. The visual function questionnaire (VFQ-39) had a mean value of 91.91 ± 6.82 . **Conclusion:** The diffractive multifocal IOL-AT LISA 809M presented results consistent with the literature as measured by tests of visual acuity with and without optical correction, contrast sensitivity curve, defocus curve and visual function questionnaire (39 VQF).

Keywords: Cataract; Lens implantation, intraocular; Eyeglasses; Visual acuity; Contrast sensitivity; Questionnaires; Treatment outcome

RESUMO

Objetivo: Avaliar a função visual dos pacientes com implante bilateral da LIO multifocal difrativa AT-Lisa 809 M™ por meio dos exames de acuidade visual com e sem correção óptica, curva de sensibilidade ao contraste, curva de desfoco e questionário de qualidade de função visual (VQF39). **Métodos:** Estudo clínico, prospectivo e de intervenção, que avaliou os resultados de 20 olhos de 10 pacientes, submetidos à facoemulsificação e implante de LIO, entre fevereiro e junho de 2012. **Resultados:** A ametropia residual média pós-operatória foi de $0,05 \pm 0,42$ (-0,75 a +1,25 D) dioptrias esféricas e $-0,30 \pm 0,42$ (0 a -1,25 D) dioptrias cilíndricas. Na curva de desfoque mono e binocular, a melhor acuidade visual média obtida com 0.00 D de desfoque (AV de longe). O segundo pico foi obtido com desfoque de -3,00 D, o que equivale à visão de perto a 33 cm. Entre esses picos, observamos uma perda de desempenho visual, com desfoque de -2,00 D, que equivale a visão intermediária a 50 cm. A sensibilidade ao contraste foi similar aos relatados na literatura com este tipo de LIO, tanto com quanto sem ofuscamento, e é mostrada em gráficos. O questionário de função visual (VFQ-39) teve valor médio de 91,91 +- 6,82. **Conclusão:** A LIO multifocal difrativa AT-Lisa 809M™ (Carl Zeiss Meditec Company – Alemanha) apresentou resultados condizentes com a literatura quando avaliada pelos exames de acuidade visual com e sem correção óptica, sensibilidade ao contraste, curva de desfoco e questionário de qualidade de função visual (VQF 39).

Descritores: Catarata; Implantação de lente intraocular; Óculos; Acuidade visual; Sensibilidade de contraste; Questionários; Resultados de tratamento

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The authors declare no conflict of interest.

Received for publication 23/9/2013 - Accepted for publication 17/11/2013

INTRODUCTION

Thanks to technological developments in modern cataract surgery, independence from glasses is now of the goals of surgery⁽¹⁻³⁾.

Among such developments, the most important are increasing biometric accuracy^(4,7), greater control over induced astigmatism with small incision techniques⁽⁸⁻¹⁰⁾, and improved intraocular lenses (IOLs)⁽¹¹⁻¹⁸⁾, including more sophisticated multifocal designs.

Multifocal IOLs have been shown to be safe and effective in restoring far and near vision, providing a high degree of independence from corrective lenses⁽¹⁹⁻²⁵⁾.

The aim of this study was to assess the visual function of patients implanted bilaterally with AT LISA 809M diffractive multifocal IOLs by testing their corrected and uncorrected visual acuity (VA), contrast sensitivity, and defocus curves and applying the visual function questionnaire (VFQ 39).

METHODS

Clinical prospective intervention study assessing 20 eyes of 10 patients submitted to phacoemulsification with implantation of AT LISA 809M diffractive multifocal IOLs. Patients were operated between February and June 2012 at the Cataract Institute (INCAT), Department of Ophthalmology, Federal University of São Paulo (UNIFESP).

Inclusion criteria were patients aged 45-70 years with bilateral cataract requiring surgery, corneal astigmatism under 0.75 D, and pupil diameter of 2.5 mm or greater. Patients with any prior eye disease that might affect visual performance were excluded from the study.

The study was approved by the Ethics Committee of the Federal University of São Paulo (Opinion number 32453) and followed the provisions of the Declaration of Helsinki. All participants provided their Free and Informed Consent.

Intraocular Lens

The AT LISA 809M (Carl Zeiss Meditec Company, Germany) is a single-piece diffractive multifocal IOL made of hydrophilic acrylic with a hydrophobic surface specifically designed for implantation in the capsular bag, with the same platform of the Acri.LISA 366D IOL. It is an aspheric refractive IOL with an adding power of +3.75 D in the lens plane. Its multifocality is due to the presence of concentric rings of different refractive indices.

Surgical Procedure

All procedures were performed by 2 experienced surgeons (LMMV and PA) under topical anaesthesia (proprilocaine hydrochloride 5 mg); the procedure consisted of phacoemulsification through a 2.75 mm incision (at the surgeon's discretion) without sutures, with intracapsular implantation of the IOL. There were no surgical complications. Postoperatively, patients were prescribed moxifloxacin (4 times a day for 7 days), dexamethasone 0.1% (with decreasing dosage) and nepafenac 0.1% (3 times a day for 1 month) eye drops.

Ophthalmic Examination

Patients underwent a complete preoperative ophthalmic examination. Calculation of the intraocular lens was done by

optical biometry using the IOLMaster (Carl Zeiss Meditec Company, Germany) device and the Haigis formula. We chose the IOL that resulted in emmetropia or the nearest negative refraction.

Uncorrected far VA was assessed using a backlit ETDRS (Early Treatment of Diabetic Retinopathy Study) chart under photopic conditions (85 cd/m²) at a standard distance of 4 metres. Near VA was assessed using a Jaeger chart converted to Snellen's notation. Intermediate VA was assessed using a defocus curve. Values were converted to logMAR units for each eye and for binocular vision.

The defocus curve was done after recording the VA with lenses of 14 different adding powers at 0.5 D intervals (-5 to +3 D). The VA for each lens power was recorded for each eye and for binocular vision. Measurements were done with the Optec 6500P device (Stereo Optical Co., Inc., Chicago, Illinois, USA), with standard assessment of far VA under photopic conditions. Three logarithmic VA charts with different optotype arrangements were used to prevent patients from memorising the chart.

Contrast sensitivity testing utilised the same device, with patients using best correction in test frames under photopic conditions (85 cd/m²) with and without glare. The test is based on the Functional Acuity Contrast Test (FACT), which assesses the contrast sensitivity curve at five spatial frequencies (1.5, 3.0, 6.0, 12, and 18 cycles per degree [cpd]).

The visual function questionnaire (VFQ 39) was applied to all patients from the third postoperative month. At all postoperative visits patients were asked whether they were experiencing halos or glare.

RESULTS

Table 1 shows the demographic data of study subjects, their dependence on glasses, and whether they experienced halos and/or glare.

Figure 1 shows the distribution of patients according to their uncorrected far and near VA (Snellen). The average postoperative residual refractive error was 0.05 ± 0.42 D (-0.75 to +1.25 D) and -0.30 ± 0.42 D cyl (0 to -1.25 D cyl).

Figure 2 shows the monocular and binocular defocus curves. The best mean VA was 0.1 LogMAR, obtained with a defocus of 0.00 D (far VA). The second peak had a mean VA of 0.2 to 0.3 LogMAR, obtained with a defocus of -3.00 D, which is equivalent to near vision at 33 cm. Between these two peaks there was a loss of visual performance, with a VA of 0.4 to 0.5 LogMAR and a defocus of -2.00 D, which is equivalent to intermediate vision at 50 cm.

Figures 3 and 4 show monocular and binocular contrast sensitivity under photopic and mesopic conditions.

DISCUSSION

The multifocality of diffractive IOLs is due to the presence of concentric rings of different refractive indices⁽²⁵⁾. Several studies have shown good outcomes with various multifocal IOLs, including diffractive IOLs⁽²⁰⁻²⁷⁾. The outcomes for far VA, with or without correction, seem to be comparable to monofocal lenses. As for uncorrected near vision, multifocal IOLs have shown better results, since the pseudophakic eye loses its accommodation ability⁽²³⁾. The disadvantages of multifocal IOLs are the loss of contrast sensitivity and increased incidence of symptoms such as halos and glare⁽²⁶⁾.

Tabela 1
Demographic data, dependence on glasses, and presence of halos and/or glare.

Patient	Age	Sex	Occupation	Glass for far vision	Glass for near vision	Glass for intermediate vision	Halos or glare/ Frequency/ Interfering with daily tasks
1	62	M	Engineer	Yes (occasionally)	No	No	Yes/ Driving at night/ No
2	62	M	Retired	No	No	No	No
3	68	M	Retired	No	No	No	No
4	60	F	Senior volley ball player	Yes (occasionally)	No	No	Yes/ At night/ No
5	56	M	Painter	No	No	No	Sim/ At night/ No
6	58	F	House wife	No	No	No	No
7	52	F	Hair dresser	No	No	No	No
8	49	F	House wife	No	No	No	No
9	64	M	Driver	No	No	No	Yes/ Driving at night/ No
10	60	F	Seamstress	No	No	No	No

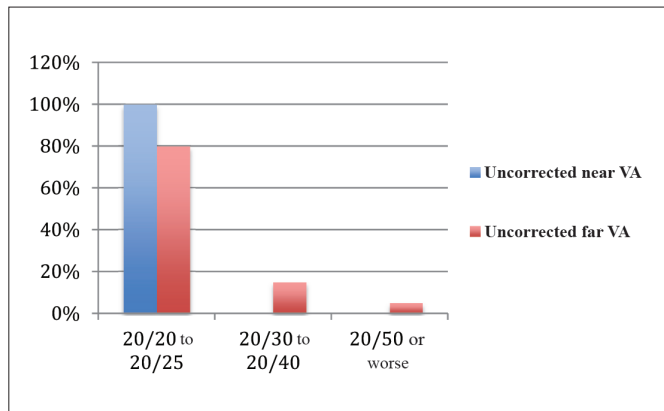


Figure 1. Uncorrected far and near VA.

Our results for monocular uncorrected far and near VA, shown in Figure 1, are in agreement with previous studies that used other multifocal IOLs⁽²⁰⁻²⁷⁾. Corrected far and near VA was 20/25 or better in all eyes. The average postoperative residual refractive error was 0.05 ± 0.42 D (-0.75 to +1.25 D) and -0.30 ± 0.42 D cyl (0 to -1.25 D cyl), which is consistent with previous studies on multifocal IOLs⁽²⁰⁻²⁷⁾. In our study, only one eye of a patient with dense posterior subcapsular cataract had an uncorrected visual acuity of 20/60 (Figure 1) due to biometric error probably secondary to cataract⁽⁴⁾. Even though previous studies and the defocus curve indicate a loss of intermediate vision⁽²⁶⁾, Table 1 shows that no patient required correction for intermediate vision.

Halos and glare are expected photic phenomena after multifocal IOL implantation because of the different light foci created by the rings for far and near vision⁽²⁶⁾. No patient spontaneously complained of halos or glare. Four patients (40%) reported such symptoms when asked about them (Table 1).

In the defocus curves, the best mean VA was 0.1 LogMAR, obtained with a defocus of 0.00 D (far VA). A second peak in mean VA (0.2 to 0.3 LogMAR) was found at a defocus of -3.00 D (near vision at 33 cm). Intermediate vision at 50 cm (at a defocus of -2.00 D) showed a decrease in visual performance, with a VA of 0.4 to 0.5 LogMAR. The AT LISA 809M IOL (Carl Zeiss Meditec Company, Germany) is a diffractive multifocal IOL which has the same platform as the Acri.LISA 366D; it is

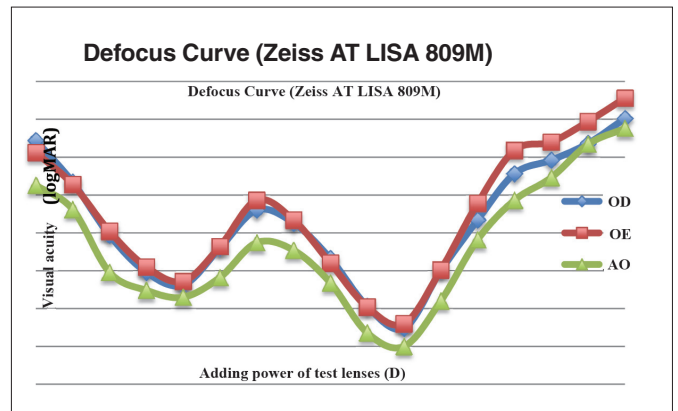


Figure 2. Defocus curve

an aspheric IOL with an adding power of +3.75 D in the lens plane. The results of our study are consistent with the literature, which shows that this type of IOL provides better far and near vision instead of intermediate vision when compared with refractive IOLs⁽²⁴⁻²⁵⁾.

A loss of contrast sensitivity is expected with multifocal IOLs, because light rays are divided into different foci to provide far and near vision⁽²⁶⁻²⁹⁾. In our study, the impairment of contrast sensitivity for far vision was consistent with results found in the literature, both with and without glare (Figures 3 and 4). Binocular contrast sensitivity was always better than monocular in both conditions (Figures 3 and 4), which is explained by the effect of binocular summation⁽²⁶⁻²⁹⁾.

The mean score obtained in the visual function questionnaire (VFQ-39) was 91.91 ± 6.82 (mean score for all 39 questions, ranging from 0 to 100). The questionnaire was not applied preoperatively. However, as shown in Table 1 and comparing our results with previous studies^(30,31), the AT LISA 809M IOL provided good patient satisfaction and independence from glasses.

CONCLUSION

The AT LISA 809M diffractive multifocal IOL provided satisfactory results for corrected and uncorrected visual acuity,

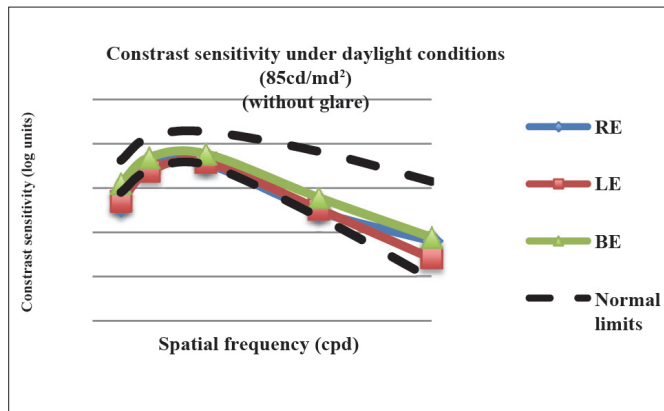


Figure 3. Contrast sensitivity curve for far vision without glare.

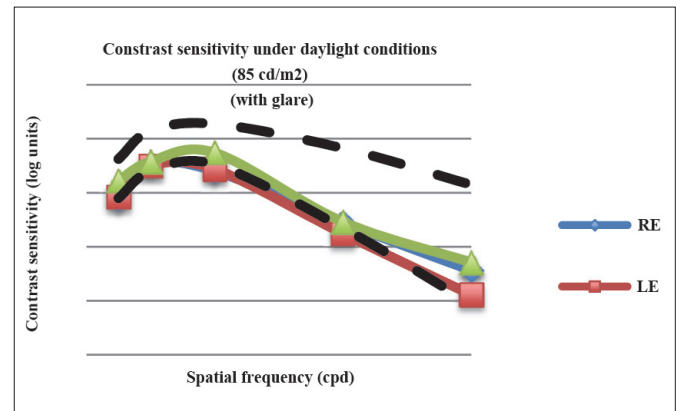


Figure 4. Contrast sensitivity curve for far vision with glare.

contrast sensitivity, defocus curves, and the visual functioning questionnaire (VQF 39), in agreement with the literature. Larger studies are needed to confirm our results and compare them with studies on other IOLs currently available in Brazil.

Acknowledgements

The authors wish to thank Flávio Hirai for reviewing the statistical methods used in this study.

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