

# Development and validation of quality of life questionnaire in pseudophakic patients in portuguese

## *Elaboração e validação do questionário de satisfação dos pacientes pseudofácicos em português*

Wilson Takashi Hida<sup>1</sup>, Celso Takashi Nakano<sup>2</sup>, Iris Yamane<sup>3</sup>, Antonio Francisco Pimenta Motta<sup>2</sup>, Patrick Frenzel Tzeliks<sup>4</sup>, Aline Silva Guimaraes<sup>2</sup>, Luciana Malta de Alencar<sup>5</sup>, Dora Selma Fix Ventura<sup>6</sup>, Milton Ruiz Alves<sup>7</sup>, Newton Kara José Júnior<sup>7</sup>

### ABSTRACT

**Purpose:** Development and validation of quality of life questionnaire in pseudophakic patients in Portuguese. **Methods:** The modified Cataract TyPE Specification questionnaire was specifically developed to assess quality of life after cataract surgery, functional status evaluated with 10 items and contains 18 questions. All questions were applied by a single examiner, with the goal of graduating visual satisfaction from 0 to 10 (0 means very dissatisfied, 5 neutral, 10 very satisfied). This prospective comparative study included 142 eyes of 71 patients in Sao Paulo University. The ophthalmologic evaluation performed included near, intermediate and distance corrected and uncorrected visual acuity and quality of life questionnaire. The minimum follow-up was 6 months. **Results:** The mean age of patients was 60.7± 6.6 years in the Tecnis<sup>®</sup>MF, 63.1 ±4.4 years in-group Restor<sup>®</sup>, 63.7±4.2 years in-group SN60AT/SN60WF. Uncorrected and distance-corrected near visual acuity were statistically higher in the Restor<sup>®</sup> and Tecnis<sup>®</sup> groups compared to the SN60AT/SN60WF group ( $p<0.001$ ). There were no statistical differences between groups comparing uncorrected and best-corrected distance visual acuity ( $p=0.56$ ). Satisfaction questionnaire showed high glasses independence for the Tecnis<sup>®</sup>MF (9.3 /10) and Restor<sup>®</sup> (8.7 /10), but with more unsatisfied of halos (18.8% Restor<sup>®</sup>, Tecnis<sup>®</sup>21, 7%) and glare (Restor<sup>®</sup> 25%; Tecnis<sup>®</sup>26.1%) than the group SN60AT/SN60WF. **Conclusion:** Cataract patients who received multifocal (Restor<sup>®</sup>; Tecnis<sup>®</sup>MF) IOLs at time of surgery obtained better uncorrected and distance corrected near visual acuity and reported better overall vision, less limitation in visual function, less spectacle dependency, and more glare or halo than those who received monofocal (SN60AT; SN60WF) IOLs. Cataract TyPE Specification questionnaire was a strong predictor of change in patient satisfaction caused by cataract surgery.

**Keywords:** Visual acuity; Vision; Cataract extraction; Lenses, intraocular; Life quality; Questionnaires; Validation studies

<sup>1</sup>Ph.D., Medical School of the São Paulo University (USP), São Paulo/SP, Brazil. Head of the Cataract Unit, Brasília Eye Hospital (HOB), Brasília/DF, Brazil.

<sup>2</sup>Researcher, Cataract Unit, Brasília Eye Hospital (HOB), Brasília/DF, Brazil.

<sup>3</sup>Ph.D., Refractive Surgery Unit, Medical School of the São Paulo University (USP), São Paulo, SP, Brazil.

<sup>4</sup>Ph.D., Cornea Unit, Brasília Eye Hospital (HOB), Brasília/DF, Brazil.

<sup>5</sup>Ph.D., Glaucoma Unit, Medical School of the São Paulo University (USP), São Paulo, SP, Brazil. Head of the Glaucoma Unit, Brasília Eye Hospital (HOB), Brasília/DF, Brazil.

<sup>6</sup>Professor, Institute of Psychology, Medical School of the São Paulo University (USP), São Paulo/SP, Brazil.

<sup>7</sup>Ph.D., Professor, Medical School of the São Paulo University (USP), São Paulo/SP, Brazil.

The authors declare no conflicts of interest

Received for publication: 19/12/2012 - Accepted for publication: 22/9/2013

## RESUMO

**Objetivo:** Elaborar e validar o questionário de qualidade de vida na versão do idioma português. **Métodos:** O questionário “Cataract TyPESpecification” modificado foi desenvolvido especificamente para avaliar a qualidade de vida pós-cirurgia de catarata. O questionário avaliou 10 itens *status* funcionais por meio de 18 perguntas. Foi aplicado por um único examinador, com o objetivo de graduar a satisfação visual de 0 a 10 (0 muito insatisfeito; 5 neutro; 10 muito satisfeito). Houve estudo prospectivo comparativo, não randomizado, que incluiu 142 olhos de 71 pacientes com catarata da Universidade de São Paulo. A avaliação oftalmológica contou com medida da acuidade visual para longa, intermediária e curta distâncias, sem correção e com a melhor correção óptica e questionário de satisfação. Foi submetido a um questionário de satisfação quanto à acuidade visual e fenômenos fóticos. Todos os exames foram realizados com 6 meses de pós-operatório. **Resultados:** A média de idade dos pacientes foi de  $60,7 \pm 6,6$  anos no grupo Tecnis,  $63,1 \pm 4,4$  anos no grupo Restor e  $63,7 \pm 4,2$  anos no grupo SN60AT/SN60WF. A acuidade visual para perto não-corrigida e a corrigida para longe foram estatisticamente superiores nos grupos Restor® e Tecnis® comparadas ao grupo SN60AT/SN60WF ( $p < 0,001$ ). Não houve diferença estatística entre os grupos quando comparadas a acuidade visual para longe não-corrigida e a melhor corrigida ( $p = 0,56$ ). O questionário de satisfação apresentou maior independência de óculos a favor da Tecnis® (9,3/10) e Restor® (8,7/10), mas com mais queixas de halos (Restor® 18,8%; Tecnis® 21,7%) e *glare* (Restor® 25%; Tecnis® 26,1%) do que no grupo SN60AT/SN60WF. **Conclusão:** A Restor® e Tecnis® apresentaram melhor acuidade visual para perto do que o grupo SN60AT/SN60WF. As lentes Restor® e Tecnis® apresentaram maior satisfação na visão de perto e independência do uso de óculos e fenômenos fóticos do que as lentes monofocais. O questionário “Cataract TyPESpecification” foi uma variável importante na qualidade de vida e satisfação do paciente após a cirurgia de catarata.

**Descritores:** Acuidade visual; Visão; Extração de catarata; Lentes intraoculares; Qualidade vida; Questionários; Estudos de validação

## INTRODUCTION

Phacoemulsification and IOL implantation using increasingly smaller incisions have allowed rapid visual recovery with low rates of complications in the hands of experienced surgeons, as well as good quality of vision in the postoperative period. Assessment of the quality of vision can be done through various tests, such as those assessing contrast sensitivity, which is the ability to distinguish the details of images and depends on ambient brightness<sup>(1-4)</sup>.

In order to provide additional benefits to the visual quality of pseudophakic patients, intraocular lenses (IOLs) have been refined using an aspherical lens design to correct positive spherical aberrations of the cornea<sup>(5-8)</sup>. One such aspherical lens is the SN60WF lens, developed from the SN60AT lens, both produced by Alcon Laboratories (Fort Worth, Texas, USA). The former provides greater reduction in spherical aberrations with better vision in low light conditions and increased contrast sensitivity in the postoperative period compared to the latter<sup>(5,6,9)</sup>.

Monofocal IOLs are traditionally used for intraocular implants in cataract surgery. Do to their lack of optical correction, they do not provide a satisfactory depth of focus at varying distances. Despite the potential benefits of multifocal IOLs, their indications are still limited<sup>(10,11)</sup>.

More advanced multifocal IOLs aim to provide contrast sensitivity similar that accepted for monofocal IOLs and to induce minimal optical aberrations. However, the scientific literature reports a loss of contrast sensitivity and functional vision associated with photic phenomena that affect patient satisfaction<sup>(12,13)</sup>.

The aim of this study was to develop and evaluate a quality of life questionnaire for patients undergoing phacoemulsification with implantation of the following IOLs: Tecnis™ MF ZM900 aspherical multifocal lens; Restor™ SN60D3 spherical multifocal lens; SN60WF aspherical monofocal lens; and SN60AT spherical monofocal lens.

## METHODS

Prospective non-randomized comparative study on 142 eyes of 71 selected patients. Subjects were recruited between March 2006 and September 2007. Evaluations took place from

January 1, 2008 to August 25, 2009 at a single centre using a single-blind, prospective, comparative design in the Cataract Unit, Department of Ophthalmology, University Hospital of the São Paulo University. The study was conducted in accordance with ethical standards for clinical and surgical research and was approved by the Ethics Committee for the Analysis of Research Projects (CAPPesq) of the Clinical Board of the University Hospital of the São Paulo University.

Inclusion criteria were: Age between 45 and 65 years; literate patients; bilateral senile cataract; corneal astigmatism under 1.00 D in both eyes; pupil diameter of at least 3.5 mm under mesopic conditions, measured using a Colvard pupillometer (Oasis Corporation, Glendora, CA, USA); and absence of any other eye disorders, eye surgery, use of topical hypotensive medications, or other systemic diseases that might affect postoperative vision with decreased contrast sensitivity, such as diabetic retinopathy. Exclusion criteria were: Intra- or postoperative complications; doubts regarding implantation of the IOL in the capsular bag; and IOL decentration greater than 0.5 mm as measured by slit lamp examination.

In total, 46 eyes of 23 patients underwent conventional phacoemulsification with implantation of Tecnis MF aspherical multifocal IOLs, and 32 eyes of 16 patients received Acrysof Restor apodised spherical multifocal IOLs. The control group comprised 64 eyes of 32 patients who underwent surgery with implantation of the Acrysof SN60WF spherical monofocal IOL in one eye and the AcrySof SN60AT spherical monofocal IOL in the other eye (Alcon Laboratories, Fort Worth, TX, USA). All procedures were performed by a single experienced surgeon (CTN) using a standardised surgical technique.

The Tecnis ZM900 multifocal IOL features 20 diffractive zones for near and far vision, with an adding power of +4.00 D in its flat refraction, corresponding to +3.20 D in the flat refraction of eye glasses. Therefore, the IOL is completely diffractive, i.e., visual performance does not depend on the pupil. The AcrySof Restor™ IOL has refractive zones for far vision and, in the centre, diffractive zones for near and far vision. It is a pupil-dependent lens. It has rings of different heights, starting with 1.4 mm in the centre and ending with 0.2 mm in the periphery, when the lens becomes refractive only. The lens has an optical adding power of +4.00 D in the central 3.6 mm with and +4.00 D in its flat refraction<sup>(12,13)</sup>.

### Annex 1

#### Modified TyPE Questionnaire

**How do you assess your vision without glasses after surgery on a scale of 0 to 10, where 0 means very dissatisfied, 5 means neutral and 10 means very satisfied (for both eyes)?**

QUESTIONNAIRE	SCORE
1) How satisfied are you with your current FAR vision?	0 1 2 3 4 5 6 7 8 9 10
2) How satisfied are you with your current INTERMEDIATE vision?	0 1 2 3 4 5 6 7 8 9 10
3) How satisfied are you with your current NEAR vision?	0 1 2 3 4 5 6 7 8 9 10
4) Would you undergo the same procedure again?	0 1 2 3 4 5 6 7 8 9 10
5) Would you undergo this procedure again only to overcome your dependency from glasses, regardless of the presence of cataract?	0 1 2 3 4 5 6 7 8 9 10
6) Would you recommend the procedure to a close friend or family member?	0 1 2 3 4 5 6 7 8 9 10

INDEPENDENCE FROM GLASSES	
7) Do you wear glasses for:	computer newspaper medicine information leafletwatch books menu pictures driving at night watching television

GLARE	
8) Do you find it difficult to read road signs due to strong lights or car headlights?	YES NO If YES: no difficulty moderate severe

HALOS	
9) Do you see rings around lights during the day?	YES NO If YES: experiencing halos, no difficulty (mild) adapting to halos (moderate) no change (severe)
10) Do you see rings around lights during the night?	YES NO If YES: experiencing halos, no difficulty (mild)adapting to halos (moderate) no change (severe)

Source: Javitt JC, Jacobson G, Schiffman RM. Validity and reliability of the Cataract TyPE Spec: an instrument for measuring outcomes of cataract extraction. Am J Ophthalmol. 2003;136(2):285-90

Best-distance near visual acuity was measured using the ETDRS chart (Precision Vision, Aurora, Colorado, USA) at a distance between 30 and 40 cm and was recorded in logMAR. Best-distance intermediate visual acuity was measured using the ETDRS chart at a distance between 50 and 70 cm. Near and intermediate visual acuity corrected for far vision was measured in logMAR using the correction obtained in manifest refraction<sup>(14,15)</sup>. Quality of life was defined as a measure of the functional capacity of an individual in multidimensional aspects, considering physical and emotional health and functional and social ability, taking into account their subjective opinion about the concept of quality<sup>(16)</sup>. The modified TyPE questionnaire (Appendix 1) was developed specifically to assess quality of life after cataract surgery. It assesses 10 functional status items using 18 questions<sup>(17,18)</sup>.

A significance level of 5% was adopted, using comparison tests such as the Tukey, Kruskal-Wallis, Mann-Whitney, and Chi-square (two-tailed) tests and adjusting the significance level when needed.

### RESULTS

The mean age of patients was 60.7 ± 6.6 years in the aspherical multifocal group, 63.1 ± 4.4 years in the spherical multifocal group, and 63.7 ± 4.2 years in the monofocal group. There were no statistically-significant differences between groups for uncorrected far visual acuity and best corrected visual acuity (p = 0.144). There were also no significant differences between groups with regard to the sex of patients. No intraoperative complications occurred.

No statistically-significant differences were found for spherical equivalent and refractive cylinder between the four IOL groups. Spherical error was -0.068 ± 0.410 D (-1 to +1) for the Tecnis™ MF group; +0.039 ± 0.312 D (-0.25 to +0.5) for the Restor™ group; -0.066 ± 0.333 for the SN60WF group; and -0.102 ± 0.403 for the SN60AT group, without statistically-significant differences between groups.

All eyes in the 4 groups were statistically equivalent for

corrected visual acuity at the final 6-month postoperative visit. Mean postoperative corrected visual acuity was +0.006 ± 0.028 logMAR units (p < 0.01) in the Tecnis™ MF group; 0.015 ± 0.052 logMAR units in the in the Restor™ group (p < 0.01); -0.07 ± 0.13 logMAR units in the SN60WF group (p < 0.01); and 0.006 ± 0.16 logMAR units in the SN60AT group (p < 0.01).

There was no statistically-significant difference in mean uncorrected monocular far visual acuity in the monofocal group compared to the multifocal groups. Intermediate (50 to 70 cm) and near (30 to 40 cm) visual acuity without optical correction was evaluated using the ETDRS™ chart (Table 1); a statistically-significant difference between lenses was found only for intermediate vision, favouring the Tecnis™ MF group (p < 0.001). No patient required optical correction for near or far vision after surgery in any everyday situation.

Mean satisfaction for far visual acuity was statistically higher in the monofocal group (SN60AT; SN60WF) than the multifocal group (Tecnis™ MF; Restor™); there was no difference between the two multifocal groups. Mean satisfaction for far visual acuity was 9.75 (± 0.40) in the monofocal group; 9.10 (± 0.63) in the Restor™ group; and 9.30 (± 0.62) in Tecnis™ MF group (Table 2).

Mean satisfaction for near visual acuity was statistically higher in the monofocal group (Tecnis™ MF; Restor™) than the multifocal group (SN60AT; SN60WF); there was no difference between the two multifocal groups. Mean satisfaction for near visual acuity was 3.75 (±1.3) in the monofocal group; 8.70 (±0.63) in the Restor™ group; and 9.30 (±0.69) in the Tecnis™ MF group.

Mean satisfaction for intermediate visual acuity was statistically higher in the Tecnis™ group than in the Restor™ and monofocal (SN60AT; SN60WF) groups; there was no difference between the Restor™ and the monofocal group. Mean satisfaction for near visual acuity was 4.00 (± 1.87) in the monofocal group; 5.60 (± 1.05) in the Restor™ group; and 7.80 (± 0.84) in Tecnis™ MF (Table 2).

There was no difference among the three groups in terms of whether patients would recommend this type of surgery. Mean satisfaction for near visual acuity was 9.29 (± 0.28) in the monofocal group; 9.10 (±0.65) in the Restor™ group; and 9.30

Table 1

**Assessing uncorrected monocular near and intermediate visual acuity in patients submitted to cataract surgery with implantation of Tecnis™ MF, Restor™, SN60AT, and SN60WF lenses**

	Tecnis™MF(N = 46)	Restor™(N = 32)	SN60WF(N = 32)	SN60AT(N = 32)
<b>Intermediate</b>				
J1 – J2	28,26% (13)	0	6,25% (2)	6,25% (2)
J3 – J4	45,65% (21)	12,5% (4)	6,25% (2)	25% (8)
J5 – J6	17,39% (8)	28,13% (9)	56,25% (18)	43,75% (14)
> J6	8,70% (4)	59,38% (19)	31,25% (10)	25% (8)

Chi-square and Fisher tests, p < 0.001, TECNIS vs. RESTOR.SN60WF.SN60AT

<b>Near</b>	N = 46	N = 32	N = 32	N = 32
J1 – J2	95,65% (44)	96,88% (31)*	0	6,25% (2)
J3 – J4	4,34% (2)	3,13% (1)	0	31,25% (10)
J5 – J6	0	0	43,75% (14)	12,50% (4)
> J6	0	0	56,25% (18)	50% (16)

Chi-square and Fisher tests, p < 0.001. TECNIS.RESTOR vs. SN60WF.SN60AT

Table 2

**Assessing satisfaction with regard to visual acuity among patients submitted to cataract surgery with implantation of Tecnis™ MF, Restor™, SN60AT, and SN60WF lenses**

<b>FAR VA</b>	<b>SN60AT/SN60WF(N=32)</b>	<b>Restor (N=16)</b>	<b>Tecnis MF(N=23)</b>
Satisfied/Very satisfied	100% (32)	87,5% (14)	87,0%
Neutral	0	12,5% (2)	13,0%
Dissatisfied/Very dissatisfied	0	0	0
Mean ± SD	9,75 ± 0,40	9,10 ± 0,63	9,30 ± 0,62

SN60AT/SN60WF >Tecnis=Restor ANOVA p=0,0085 Kruskal-Wallis p<0,0001

<b>NEAR VA</b>	<b>(N=32)</b>	<b>(N=16)</b>	<b>(N=23)</b>
Satisfied/Very satisfied	3,1% (1)	81,3% (13)	95,7% (21)
Neutral	12,5% (4)	18,8% (3)	4,4% (2)
Dissatisfied/Very dissatisfied	84,4% (27)	0	0
Mean ± SD	3,75 ± 1,3	8,70 ± 0,63	9,30 ± 0,69

SN60AT/SN60WF >Tecnis=Restor ANOVA p<0,0001 Kruskal-Wallis p<0,0001

<b>INTERMEDIATE VA</b>	<b>(N=32)</b>	<b>(N=16)</b>	<b>(N=23)</b>
Satisfied/Very satisfied	15,6% (5)	43,8% (7)	69,6% (16)
Neutral	25% (8)	50% (8)	30,4% (7)
Dissatisfied/Very dissatisfied	59,4% (19)	6,3% (1)	0
Mean ± SD	4,00 ± 1,87	5,60 ± 1,05	7,80 ± 0,84

Tecnis>SN60AT/SN60WF = Restor ANOVA p<0,0001 Kruskal-Wallis p<0,0001

<b>RECOMMENDING SURGERY</b>	<b>(N=32)</b>	<b>(N=16)</b>	<b>(N=23)</b>
Satisfied/Very satisfied	65,6% (21)	75% (12)	78,3% (18)
Neutral	21,9% (7)	18,8% (3)	13% (3)
Dissatisfied/Very dissatisfied	12,5% (4)	6,3% (1)	8,7% (2)
Mean ± SD	9,29 ± 0,28	9,10 ± 0,65	9,30 ± 0,52

ANOVA p=0,475 Kruskal-Wallis p=0,706

(± 0.52) in Tecnis™ MF group (Table 2).

The satisfaction rate for glare was statistically superior in multifocal group (Tecnis™ MF; Restor™) than the monofocal group (SN60AT; SN60WF); there was no difference between the two multifocal groups. The satisfaction rate for glare was 25% in the Restor™ group; 26.1% in the Tecnis™ MF group; and none in the monofocal group (Table 3).

The satisfaction rate for night halos was statistically higher in the multifocal group (Tecnis™ MF; Restor™) than in the monofocal group (SN60AT; SN60WF); there was no difference between the two multifocal groups. The satisfaction rate for glare was 18.8% in the Restor™ group; 21.7% in the Tecnis™ MF group; and none in the monofocal group. The satisfaction rate for day halos did not differ between the three groups (Table 3).

The rate of independence from glasses when using a computer was statistically higher in the Tecnis™ MF group than in the Restor™ and monofocal (SN60AT; SN60WF) groups; there was no difference between the two multifocal groups. The utilisation rate of glasses was 43.8% in the Restor™ group; 62.5% in the monofocal group; and 17.4% in Tecnis™ MF group (Table 4).

The rate of independence from glasses when reading the

newspaper, medicine bottles, books, menus, watching pictures, driving, and looking at the watch was statistically higher in the multifocal groups (Tecnis™ MF; Restor™) than in the monofocal group (SN60AT; SN60WF); there was no difference between the two multifocal groups (Table 4).

## DISCUSSION

The four groups were compared with regard to age and sex, two variables that might influence patient satisfaction. Mean age was over 60, i.e. patients were possibly economically active. Socioeconomic status and daily/professional activities were not evaluated but are important in selecting patients for multifocal IOL implantation, because patients who perform night activities, such as driving and playing sports, among others, may not have the same level of satisfaction as those who do not perform these activities, due to the influence of photic phenomena such as halo and glare triggered by such lenses. Patients who require a more accurate intermediate vision, especially computer users, may not have the same level of satisfaction as patients who need to read at an average distance of 40 cm. There is a widespread yet undemonstrated notion that women tend to accept photic

**Table 3**

**Assessing satisfaction with regard to halos and glare among patients submitted to cataract surgery with implantation of Tecnis™ MF, Restor™, SN60AT, and SN60WF lenses**

Glare	SN60AT/SN60WF(N=32)	Restor®(N=16)	Tecnis®MF(N=23)
YES	0	25,0% (4)*	26,1% (6)*
No difficulty	0	12,5% (2)	13,0% (3)
Moderate	0	12,5% (2)	4,4% (1)
Severe	0	0	8,7% (2)

\*Teste de Fisher Restor®>SN60AT/ SN60WF p=0,0094 Tecnis®>SN60AT/ SN60WF p=0,0035

Day Halos	(N=32)	(N=16)	(N=23)
YES	0	6,3% (1)	8,8% (2)
Experiencing halos	0	6,3% (1)	4,4% (1)
Improving	0	0	4,4% (1)
No change	0	0	0

Teste de Fisher ns - p=0,1704

Night Halos	(N=32)	(N=16)	(N=23)
YES	0	18,8% (3)	21,7% (5)
Experiencing halos	0	12,5% (2)	13,0% (3)
Improving	0	6,3% (1)	8,7% (2)
No change	0	0	0

\* Fisher test: Restor>SN60AT/ SN60WF, p=0.0097; Tecnis>SN60AT/ SN60WF, p=0.0324

**Table 4**

**Assessing satisfaction with regard to independence from glasses among patients submitted to cataract surgery with implantation of Tecnis™ MF, Restor™, SN60AT, and SN60WF lenses**

Independence from Glasses	SN60AT/SN60WF (N=32)	Restor (N=16)	Tecnis MF (N=23)
Computer	62,5% (20)*	43,8% (7)*	17,4% (4)
Newspaper	78,1% (25)*	12,5% (2)	8,7% (2)
Medicine information leaflet	93,8% (30)*	6,3% (1)	4,3% (1)
Books	96,9% (31)*	37,5% (6)	17,4% (4)
Menu	81,3% (26)*	0	0
Watching pictures	46,9% (15)*	25,0% (4)	8,7% (2)
Driving by day	9,4% (3)	18,8% (3)	8,7% (2)
Driving by night	6,3% (2)	6,3% (1)	4,3% (1)
Looking at the watch	31,3% (10)*	12,5% (2)	4,3% (1)

\* Fisher test, p<0.001; SN>RS=TC (Computer, SN=RS>TC)

phenomena better in exchange for being independent from glasses. Likewise, elderly individuals would tend to be more tolerant of visual quality.

We applied the TyPE questionnaire, a satisfaction questionnaire developed to assess quality of life after multifocal IOL implantation, not available in this study.

This is an important method to assess and compare the satisfaction of subjects included in the four groups<sup>(17,18)</sup>. It is also in agreement with the idea that hyperopic patients would have

milder symptoms than myopic patients, although this comparison was not done in this study<sup>(19)</sup>.

There was no difference in spherical equivalent between study groups. The refractive outcome was very close to emmetropia, which was our goal. This reaffirms the importance of biometry performed by an experienced examiner using the immersion method or interferometry, which are highly accurate. This is important because inducing a negative refractive result would favour uncorrected near vision, but would also worsen far

vision. Anyway, this effect would be eliminated when measuring near vision with correction for far vision. Another important point is the fact that no patients had a refractive outcome greater than 1 D, which could lead to increased frequency and severity of photic phenomena<sup>(20)</sup>.

Our results for uncorrected visual acuity and visual acuity corrected for far vision among patients who received the Tecnis™ MF and Restor™ lenses are in agreement with the literature. In a European multicentre study, Kohnen et al.<sup>(21)</sup> found that all patients who received Restor™ lenses achieved an uncorrected far visual acuity of 20/40 or better, and 97.5% of patients achieved an uncorrected near vision of 20/40 or better.

Sallet et al.<sup>(12)</sup> reported uncorrected far visual acuity better than 20/30 in all eyes and uncorrected near visual acuity of Jagger 3 or better in all patients.

These findings are supported by data in the literature showing that multifocal intraocular lenses provide better uncorrected near visual acuity than monofocal lenses<sup>(22,23)</sup>.

All measures of binocular near visual acuity were better than monocular measures. This has also been observed in previous studies on multifocal lenses<sup>(23,24)</sup>.

Uncorrected near vision in the Restor™ group was comparable to best corrected near vision in the monofocal group, allowing most daily short-distance activities to be performed without the need for optical correction. Despite the formation of two images, there is only one effective focus, chosen by the patient, which will depend on the distance of the object to be focused on. The good uncorrected near vision obtained in the Restor™ group can be explained by the fact that this lens has an addition power of +4.0 D in its diffractive structure (+3.5 diopters in the glasses plane). This may also explain the fact that corrected near vision was better in the Restor™ group, as the adding power in the monofocal group was limited to +3.0 D.

In our study, uncorrected intermediate visual acuity and best corrected far visual acuity among patients in the Restor™ group was in agreement with the results of Blaylock et al.<sup>(25)</sup>, where mean visual acuity was 20/36 and 20/38 respectively. However, the same study found better intermediate visual acuity with monofocal SA60AT lenses compared to Restor™ lenses, which was not observed in our study for the assessed distances. Another study that assessed intermediate visual acuity with Restor™ lenses found worse visual acuity for distances of 50, 60 and 70 cm compared to 33 cm. Although these studies found a worse intermediate visual acuity, the average intermediate visual acuity at 70 cm was comparable with that found in our study.

We found a better monocular intermediate visual acuity corrected for far vision in the multifocal groups (Restor™, Tecnis™ MF) compared to the monofocal group (SN60AT; SN60AT) for distances of 40-50 cm. At 50-60 cm corrected for far vision, the Tecnis™ MF group was statistically superior to all other groups. With respect to distances 40-60 cm, the Tecnis™ MF group was superior. For 50-70 cm, an improvement in the mean and median was found in the monofocal group. If intermediate vision was assessed at distances greater than 70 cm, a statistically significant difference in visual acuity favouring the monofocal group (SN60AT; SN60AT) would probably be found. There was no disagreement between our results and the literature on near and intermediate visual acuity favouring multifocal lenses over monofocal lenses<sup>(22,28-30)</sup>. Hutz et al.<sup>(28)</sup> reported similar data on the superiority of Tecnis™ MF lenses for intermediate vision compared with Restor™ and other monofocal lenses.

Leyland et al.<sup>(22)</sup> did a meta-analysis of studies comparing multifocal and monofocal lenses and reported a better uncorrected far visual acuity in patients with monofocal lenses, while other studies found no difference<sup>(29,30)</sup>. This can be explained by the fact that part of the light is split to a focus anterior to the retina in near vision, while with monofocal lenses all energy is concentrated in the far focus.

The assessment of quality of life is based on the patient satisfaction questionnaire and it is one of the most important subjective evaluations on the outcome of cataract surgery. In our study, all patients who completed the questionnaire had undergone cataract surgery with implantation of monofocal or multifocal lenses. Thus, our data reflect the satisfaction of patients undergoing cataract surgery only. It is worth noting that our results reflect a high level of satisfaction with visual recovery as well as independence from glasses<sup>(17,31,32)</sup>.

The multifocal Tecnis™ and Restor™ MF groups showed a higher level of satisfaction with near vision and a lower need for glasses than the monofocal group, as well as a higher incidence of halo and glare. Several studies showed results similar to ours using the same satisfaction questionnaire on patients submitted to cataract surgery with implantation of different types of multifocal and monofocal intraocular lenses<sup>(17,32-35)</sup>. Berdeaux et al.<sup>(33)</sup> found similar results when comparing Restor™ (MA60D3) and AcrySof™ Monofocal (MA60BM) lenses.

However, it should be noted this is a subjective assessment based on data collected with patients in the postoperative period. It aims to quantify ophthalmic results among patients, but it reflects the impression of surgeons as to the results. Despite its design and scope limitations, our assessment has accomplished his goal.

## CONCLUSION

After analysing the data obtained in this study, we can conclude that the Tecnis™ and Restor™ MF multifocal intraocular lenses led to a visual acuity comparable to monofocal SN60WF and SN60AT lenses for far vision and to a better uncorrected near vision. All lenses caused less spherical high-order and total aberrations than SN60AT monofocal lenses. The Tecnis™ and Restor™ MF lenses provided a higher level of satisfaction with near vision and independence from glasses, as well as a higher incidence of photic phenomena, than the SN60AT and SN60WF monofocal lenses. The modified Type questionnaire significantly influenced the satisfaction of patients submitted to cataract surgery with implantation of different intraocular lenses.

## REFERENCES

1. Marcos S, Barbero S, Jiménez-Alfaro I. Optical quality and depth-of-field of eyes implanted with spherical and aspheric intraocular lenses. *J Refract Surg.* 2005;21(3):223-35.
2. Frström B, Lundh BL. Colour contrast sensitivity with different intraocular lens materials in the right and left eyes in same day surgery. *Acta Ophthalmol Scand.* 2005;83(4):443-7.
3. Rodríguez-Galietero A, Montés-Micó R, Muñoz G, Albarrán-Diego C. Comparison of contrast sensitivity and color discrimination after clear and yellow intraocular lens implantation. *J Cataract Refract Surg.* 2005;31(9):1736-40.
4. Oliveira F, Muccioli C, Silva LM, Soriano ES, Souza CE, Belfort Júnior R. Avaliação da sensibilidade ao contraste e da estereopsia em pacientes com lente intra-ocular multifocal. *Arq Bras Oftalmol.* 2005;68(4):439-43.

5. Dietze HH, Cox MJ. Limitations of correcting spherical aberration with aspheric intraocular lenses. *J Refract Surg.* 2005;21(5):S541-6.
6. Altmann GE. Wavefront-customized intraocular lenses. *Curr Opin Ophthalmol.* 2004;15(4):358-64.
7. Kershner RM. Retinal image contrast and functional visual performance with aspheric, silicone, and acrylic intraocular lenses. Prospective evaluation. *J Cataract Refract Surg.* 2003;29(9):1684-94.
8. Muñoz G, Albarrán-Diego C, Montés-Micó R, Rodríguez-Galietero A, Alió JL. Spherical aberration and contrast sensitivity after cataract surgery with the Tecnis Z9000 intraocular lens. *J Cataract Refract Surg.* 2006;32(8):1320-7. Comment in *J Cataract Refract Surg.* 2007;33(3):359-60; author reply 360-61.
9. Bellucci R, Scialdone A, Buratto L, Morselli S, Chierago C, Criscuoli A, et al. Visual acuity and contrast sensitivity comparison between Tecnis and AcrySof SA60AT intraocular lenses: A multicenter randomized study. *J Cataract Refract Surg.* 2005;31(4):712-7. Erratum in *J Cataract Refract Surg.* 2005;31(10):1857.
10. Nochez Y, Majzoub S, Pisella PJ. Effect of residual ocular spherical aberration on objective and subjective quality of vision in pseudophakic eyes. *J Cataract Refract Surg.* 2011;37(6):1076-81.
11. Nemeth G, Tsorbatzoglou A, Vamosi P, Sohajda Z, Berta A. A comparison of accommodation amplitudes in pseudophakic eyes measured with three different methods. *Eye (Lond).* 2008;22(1):65-9.
12. Sallet G. Refractive outcome after bilateral implantation of an apodized diffractive intraocular lens. *Bull Soc Belge Ophthalmol.* 2006(299):67-73.
13. Rekas M, Zelichowska B. Multifocal diffractive intraocular lenses in cataract surgery—preliminary report. *Klin Oczna.* 2006;108(4-6):186-90.
14. Christie B, Nordan L, Chipman R, Gupta A. Optical performance of an aspheric multifocal intraocular lens. *J Cataract Refract Surg.* 1991;17(5):583-91.
15. Hida WT, Motta AF, Kara-José Júnior N, Costa H, Tokunaga C, Cordeiro LN, et al. Estudo comparativo do desempenho visual e análise de frente de onda entre as lentes intra-oculares multifocais difrativas Tecnis® ZM900 e AcrySof® ReSTOR® SN60D3. *Arq Bras Oftalmol.* 2008;71(6):788-92.
16. Scott IU, Schein OD, West S, Bandeen-Roche K, Enger C, Folstein MF. Functional status and quality of life measurement among ophthalmic patients. *Arch Ophthalmol.* 1994;112(3):329-35.
17. 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):2040-8.
18. Leyland MD, Langan L, Goolfee F, Lee N, Bloom PA. Prospective randomised double-masked trial of bilateral multifocal, bifocal or monofocal intraocular lenses. *Eye (Lond).* 2002;16(4):481-90.
19. Bellucci R, Giardini P. Pseudoaccommodation with the 3M diffractive multifocal intraocular lens: a refraction study of 52 subjects. *J Cataract Refract Surg.* 1993;19(1):32-5.
20. Dick HB, Krummenauer F, Schwenn O, Krist R, Pfeiffer N. Objective and subjective evaluation of photic phenomena after monofocal and multifocal intraocular lens implantation. *Ophthalmology.* 1999;106(10):1878-86.
21. Kohnen T, Allen D, Boureau C, Dublineau P, Hartmann C, Mehdorn E, et al. European multicenter study of the AcrySof ReSTOR apodized diffractive intraocular lens. *Ophthalmology.* 2006;113(4):584.e1.
22. Leyland M, Zinicola E. Multifocal versus monofocal intraocular lenses in cataract surgery: a systematic review. *Ophthalmology.* 2003;110(9):1789-98.
23. 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):1243-55. Comment in *Ophthalmology.* 2000;107(10):1801.
24. Arens B, Freudenthaler N, Quentin CD. Binocular function after bilateral implantation of monofocal and refractive multifocal intraocular lenses. *J Cataract Refract Surg.* 1999;25(3):399-404.
25. 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):1464-73.
26. Packer M, Chu YR, Waltz KL, Donnenfeld ED, Wallace RB 3rd, Featherstone K, et al. Evaluation of the aspheric tecnis multifocal intraocular lens: one-year results from the first cohort of the food and drug administration clinical trial. *Am J Ophthalmol.* 2010;149(4):577-84.e1.
27. Kim MJ, Zheleznyak L, Macrae S, Tchah H, Yoon G. Objective evaluation of through-focus optical performance of presbyopia-correcting intraocular lenses using an optical bench system. *J Cataract Refract Surg.* 2011;37(7):1305-12.
28. Hütz WW, Eckhardt HB, Röhrig B, Grolmus R. Intermediate vision and reading speed with array, Tecnis, and ReSTOR intraocular lenses. *J Refract Surg.* 2008;24(3):251-6.
29. 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):1459-63. Erratum in *J Cataract Refract Surg.* 2006;32(12):1987.
30. Allen ED, Burton RL, Webber SK, Haaskjold E, Sandvig K, Jyrkkio H, et al. Comparison of a diffractive bifocal and a monofocal intraocular lens. *J Cataract Refract Surg.* 1996;22(4):446-51.
31. 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):589-99.
32. Leyland M, Pringle E. Multifocal versus monofocal intraocular lenses after cataract extraction. *Cochrane Database Syst Rev.* 2006;(4):CD003169. Update in *Cochrane Database Syst Rev.* 2012;9:CD003169.
33. Berdeaux G, Viala M, Roborel de Climens A, Arnould B. Patient-reported benefit of ReSTOR multi-focal intraocular lenses after cataract surgery: results of principal component analysis on clinical trial data. *Health Qual Life Outcomes.* 2008;6:10.
34. Javitt JC, Jacobson G, Schiffman RM. Validity and reliability of the Cataract TyPE Spec: an instrument for measuring outcomes of cataract extraction. *Am J Ophthalmol.* 2003;136(2):285-90.
35. Lundström M, Pesudovs K. Questionnaires for measuring cataract surgery outcomes. *J Cataract Refract Surg.* 2011;37(5):37:945-59

---

**Corresponding author:**

Wilson Takashi Hida

Rua Afonso de Freitas, nº 488 - apto 61 - Paraíso  
CEP 04006-052 - São Paulo (SP), Brasil