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Evaluation of life quality of patients submitted to cataract surgery with implants of monofocal, bifocal and multifocal lenses

Avaliação da qualidade de vida em pacientes submetidos à cirurgia de catarata, com implantes de lentes monofocais bifocais e multifocais

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ABSTRACT

Purpose: *Providing an objective and subjective evaluation of life quality and satisfaction level of the patients who underwent cataract surgery with implant of bifocal, multifocal and monofocal lenses.* ***Methods:*** *Bifocal lenses were implanted in 72 patients, aspheric multifocal lenses in 16 patients, apodized multifocal lenses in 20 patients and Monofocal lenses were implanted in 63 patients. The patients answered a 47 question questionnaire, whose results were evaluated and analyzed.* ***Results:*** *The level of satisfaction of the patients implanted with bifocal and multifocal lenses was significantly higher than of those with monofocal lenses (kruskal – Wallis test, p< 0.001 followed by the Dunn test, p< 0.05). As to the comparison of monofocal lenses with bifocal and multifocal lenses, the near vision without correction was considerably lower in patients with monofocal lenses (Z test p< 0.001). The patients with monofocal lenses without correction presented a much lower capacity of reading newspapers or books and as far as manual work than the ones with bifocal and multifocal lenses (Z test, p<0.001).* ***Conclusion:*** *The result of this study shows that the patients who received the bifocal and multifocal lenses had a remarkable improvement in their visual acuity for the near vision, being pleased with their general vision without wearing glasses. This is because they were able to read books and newspapers, write checks, fill out forms, do sports, shave or put on make-up, hence having high quality of life without correction.*

Keywords: *Life quality; Intraocular lenses; Cataract extraction; Questionnaires*

RESUMO

Objetivo: Fornecer uma avaliação objetiva e subjetiva da qualidade de vida e o nível de satisfação de pacientes que se submeteram à cirurgia de catarata, com implante de lentes bifocais, multifocais e monofocais. **Métodos:** Lentes bifocais foram implantadas em 72 pacientes; lentes multifocais asférica em 16 pacientes; lentes multifocais apodizada em 20 pacientes e lentes monofocais em 63 pacientes. Foi aplicado um questionário de 47 perguntas cujos resultados foram avaliados e analisados. **Resultados:** O nível de satisfação dos pacientes implantados com lentes bifocais e multifocais foi significantemente mais alto do que aqueles com lentes monofocais (teste Kruskal-Wallis p<0,01, seguido do teste Dunn, p<0,05). Quanto à comparação de lentes monofocais com lentes bifocais e multifocais, a visão para perto sem correção foi consideravelmente mais baixa em pacientes com lentes monofocais (teste Z, p<0,001). Os pacientes com lentes monofocais sem correção apresentaram uma menor capacidade de ler jornais ou livros e no que diz respeito a trabalhos manuais do que aqueles com lentes bifocais e multifocais (teste Z, p<0,001). **Conclusão:** Os resultados deste estudo mostram que os pacientes que receberam as lentes bifocais e multifocais tiveram uma melhora notável em sua acuidade visual para perto, estando satisfeitos com sua visão geral, sem óculos. A satisfação foi atribuída ao fato de conseguirem ler livros e jornais, preencher cheques, preencher formulários, praticar esportes, se barbear ou se maquiar sem correção.

Descritores: Qualidade de vida; Lentes intraoculares; Extração de catarata; Questionários

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Introduction

The eye typically undergoes two physiological phenomena during its aging process: loss of ability to focus at varying distances (presbyopia) and gradual opacification of the lens in most patients (cataract). Impaired accommodation is usually compensated with bifocal or multifocal glasses, while cataract is usually treated surgically by removing the lens and implanting an intraocular lens (IOL). Despite advances in cataract surgery in many parts of the world, cataract is the leading cause of surgically-preventable blindness. In 2002 cataract was responsible for an estimated 37 million cases of blindness among 161 million visually-impaired individuals. Cataract is believed to account for 48% of all visual impairments[1]. Its worldwide distribution is not uniform. It is estimated that 10% of the population over 50 years of age has cataract, a prevalence that increases to 50% in persons aged 65-74 years and 75% in persons older than 75 years[2].

Cataract surgery improved with the advent of the phacoemulsifier to fragment the crystalline, a technique that evolved for 20 years before spreading in the late 80's. It leads to rapid visual recovery and more controlled healing, with better control over surgical time[3]. Successive generations of monofocal IOLs have also provided a good level of satisfaction among both surgeons and patients. These IOLs are still the most commonly used to replace the crystalline lens in cataract surgery. However, monofocal IOLs have limitations as they only provide good visual acuity in a single focal plane, either far or near. Patients usually need glasses to perform activities that require a better visual acuity in the focal plane not corrected by the chosen IOL[4,5]. Multifocal IOLs provide better visual performance than monofocal IOLs, as they improve both near and far visual acuity with little or no correction. Although some patients with bifocal or multifocal IOLs require correction for extremely detailed near vision, it is usually not greater than 1.50 dioptres[4]. However, clinical and laboratory studies have shown a decrease in image quality and contrast sensitivity and a greater incidence of halos and glare at night with multifocal IOLs[6,7].

In 1862 the Dutch ophthalmologist Snellen was the first to develop a visual chart based on the finding that most persons with normal visual acuity had a visual angle of up to one minute for black objects on a white background. He used upper-case letters of the alphabet, which have certain angles at specific distances. The process of identifying letters is influenced by experience, familiarity and psychological factors, which can lead to incorrect interpretation depending on a letter's configuration. Despite these factors, it is still the preferred clinical test[8]. It has been noted that even patients whose vision is not ideal according to Snellen's chart report being satisfied with the outcome of cataract surgery. This is why it is important to examine the quality of life and personal satisfaction of patients through questionnaires assessing their ability to perform daily tasks with or without correction, such as reading traffic signs; making handicrafts (sewing and embroidering); writing cheques or filling in forms; playing bingo, dominoes, or cards; playing sports; cooking; watching television; driving at day and night; and shaving or applying makeup. This is a more reliable way to know whether patients are satisfied with their visual outcome after cataract surgery.

Methods

The study included 171 patients from the CIOMS (Integrated Ophthalmic Centre of Mato Grosso do Sul) Eye Hospital. A questionnaire (Appendix 1) with 47 questions assessing patient satisfaction, the need for eye glasses, and quality of life was administered to all patients by the same examiner. The questionnaire was developed by combining 3 questionnaires that had been previously validated in a pilot project[5,7,9] on 72 patients (mean age, 69 years) submitted to cataract surgery with implantation of biconvex refractive bifocal lenses (Array SA40N, AMO Inc.) in both eyes. This group was prospectively compared with: 16 patients (mean age, 60 years) implanted with biconvex multifocal aspheric diffractive IOLs (Tecnis ZM900, AMO inc.); 20 patients (mean age, 65 years) implanted with apodised multifocal diffractive-refractive IOLs (Restor SA60D3, Alcon Inc.); and 63 patients (mean age, 66 years) implanted with biconvex monofocal spherical IOLs (Clariflex SI40NB, AMO inc.).

All patients underwent surgery in both eyes. All patients provided their Free and Informed Consent, and the study was approved by the Research Ethics Committee (REC) of the Federal University of São Paulo. The questionnaire was applied approximately 2 years (22-26 months) after surgery due to the need for neural adaptation to bifocal or multifocal IOLs[10].

The inclusion criteria for bifocal or multifocal IOLs were patients submitted phakectomy without surgical complications, a centred IOL, and clear media. The exclusion criteria were: (1) patients with preoperative eye conditions that might compromise visual acuity, such as diabetes mellitus, uveitis, glaucoma, previous eye surgery, and maculopathy; and (2) patients with intra- or postoperative complications (posterior capsule rupture, discontinuous capsulorhexis, uveitis, endophthalmitis), preoperative corneal topographic astigmatism greater than 1.00 D cyl, IOL dislocation (when possible, the IOL was recentered). (3) Patients who did not adhere to postoperative treatment or did not attend follow-up visits.

Characteristics of the IOLs

The Clariflex biconvex monofocal spherical IOL is a 3-piece IOL with a 6.0-mm silicone optical zone and C-shaped polyvinylidene haptics with an angulation of 10 degrees.

The Array SA40N biconvex bifocal refractive IOL has progressive bifocal areas with 5 concentric refractive zones for near and far vision: zones 1, 3 and 5 for far vision and zones 2 and 4 for near vision; its adding power is 3.50 D; it is a 3-piece IOL with a silicone optical zone and polyvinylidene haptics.

The Tecnis ZM900 biconvex aspheric diffractive IOL is a multifocal silicone IOL implanted in the posterior chamber. It is a 3-piece IOL with a biconvex optic and flexible haptics. The haptics are made of polyvinylidene fluoride and are C-shaped, with an anterior angulation of 6 degrees. Its total diameter is 13.0 mm, with a 6.0-mm optical zone. It has a prolate anterior surface and a diffractive posterior surface. The diffraction pattern consists of 32 concentric rings with steps of approximately 0.25 mm. The central zone is 1.0-mm wide. The anterior surface has a spherical aberration of -0.27 mm for a 6.0-mm pupil. Its adding power is +3.75 D for near vision. Its refractive index is 1.46 at 37°C, with a constant of 119.8[11].

The Restor SN60D3 is an apodised multifocal refractive-diffractive IOL. It is a single-piece IOL made of hydrophobic

Annex A1

Questionnaire to assess patients implanted bilaterally with bifocal or multifocal IOLs versus monofocal IOLs.

Name:
Age:
Sex: female ( ) male ( )
Occupation:

1) How often do you need glasses for far vision? ( )
2) How often do you need glasses for near vision? ( )
(1) Never (2) Infrequently (3) Half of the time (4) Frequently (5) Always
3) How satisfied are you with your overall vision? ( )
4) How satisfied are you with your vision during the day? ( )
5) How satisfied are you with your vision during the night? ( )
6) How satisfied are you with your overall vision without glasses? ( )
7) How satisfied are you with your overall vision with glasses? ( )
8) How satisfied are you with your far vision with glasses? ( )
9) How satisfied are you with your far vision without glasses? ( )
10) How satisfied are you with your near vision with glasses? ( )
11) How satisfied are you with your near vision without glasses? ( )
(1) completely unsatisfied (2) unsatisfied (3) indifferent (4) satisfied (5) very satisfied
12) Do you feel discomfort due to halos, rings or glare around light sources?
(1) Never (2) Infrequently (3) Half of the time (4) Frequently (5) Always
13) Have you lost the ability to perform some activity after surgery? ( )
14) If yes, what? .....
15) Were there any complications during surgery? ( )
16) If yes, what? .....
17) Can you read small print such as medicine information leaflets, phone books or food labels (without glasses)? ( )
18) Can you read small print such as medicine information leaflets, phone books or food labels (with glasses)? ( )
19) Can you read a newspaper or book (without glasses)? ( )
20) Can you read a newspaper or book (with glasses)? ( )
21) Can you read a book with large print or the numbers in a telephone pad (without glasses)? ( )
22) Can you read a book with large print or the numbers in a telephone pad (with glasses)? ( )
23) Can you recognise people near you (without glasses)? ( )
24) Can you recognise people near you (with glasses)? ( )
25) Can you see steps or stairs (without glasses)? ( )
26) Can you see steps or stairs (with glasses)? ( )
27) Can you read traffic signs (without glasses)? ( )
28) Can you read traffic signs (with glasses)? ( )
29) Can you make handicrafts such as sewing and embroidering (without glasses)? ( )
30) Can you make handicrafts such as sewing and embroidering (with glasses)? ( )
31) Can you write cheques or fill in forms (without glasses)? ( )
32) Can you write cheques or fill in forms (with glasses)? ( )
33) Can you play bingo, domino or cards (without glasses)? ( )
34) Can you play bingo, domino or cards (with glasses)? ( )
35) Can you play sports such as bowling, handball, tennis or golf (without glasses)? ( )
36) Can you play sports such as bowling, handball, tennis or golf (with glasses)? ( )
37) Can you cook (without glasses)? ( )
38) Can you cook (with glasses)? ( )
39) Can you watch TV (without glasses)? ( )
40) Can you watch TV (with glasses)? ( )
41) Can you drive during the day (without glasses)? ( )
42) Can you drive during the day (with glasses)? ( )
43) Can you drive during the night (without glasses)? ( )
44) Can you drive during the night (with glasses)? ( )
45) Can you shave or apply makeup (without glasses)? ( )
46) Can you shave or apply makeup (with glasses)? ( )
47) Did you pass your driver's licence tests? ( )
(1) yes (2) no

Table 1

Patient satisfaction with regard to overall vision, day and night vision, and uncorrected near and far vision among subjects implanted with different types of IOLs.

Variable	Monofocal	Bifocal	Aspheric	Apodized	p-value
Satisfaction with overall vision	**Satisfied**± (unsatisfied and very satisfied)	**Very satisfied**± (Unsatisfied and very satisfied)	**Very satisfied**± (Very satisfied and very satisfied)	**Very satisfied**± (Satisfied and very satisfied)	p<0,001 Array SA40N, Technis and Restor > Monofocal
Satisfaction with overall day vision	**Satisfied**± (unsatisfied and very satisfied)	**Very satisfied**± (Unsatisfied and very satisfied)	**Very satisfied**± (Very satisfied and very satisfied)	**Very satisfied**± (Very satisfied and very satisfied)	p<0,001 Technis and Restor > Monofocal
Satisfaction with overall night vision	**Satisfied**± (completely unsatisfied and very satisfied)	**Very satisfied**± (Unsatisfied and very satisfied)	**Very satisfied**± (Very satisfied and very satisfied)	**Very satisfied**± (Very satisfied and very satisfied)	p<0,001Array SA40N, Technis and Restor > Monofocal
Satisfaction with overall vision without glasses	**Satisfied**± unsatisfied and very satisfied)	**Very satisfied**± (Unsatisfied and very satisfied)	**Very satisfied**± (Very satisfied and very satisfied)	**Very satisfied**± (Satisfied and very satisfied)	p<0,001Array SA40N, Technis and Restor > Monofocal
Satisfaction with far vision without glasses	**Satisfied**± unsatisfied and very satisfied)	**Very satisfied**± (Completely unsatisfied and very satisfied)	**Very satisfied**± (Very satisfied and very satisfied)	**Very satisfied**± (Satisfied and very satisfied)	p<0,001Array SA40N, Technis and Restor > Monofocal
Satisfaction with near vision without glasses	**Unsatisfied**± (completely unsatisfied and satisfied)	**Satisfied**± (Completely unsatisfied and very satisfied)	**Very satisfied**± (Satisfied and very satisfied)	**Very satisfied**± (Satisfied and very satisfied)	p<0,001Array SA40N, Technis and Restor >Monofocal

Results are presented as median ± minimum and maximum. Comparisons were done using the Kruskal-Wallis test followed by Dunn's post-test.

acrylic with a 6.0 mm optic part and a total diameter of 13.0 mm. It has a yellow filter to block light in the blue spectrum. Its multifocal diffractive rings are in the centre and occupy an area with a 3.6 mm diameter. It is a hybrid apodised multifocal refractive-diffractive lens with an adding power of +4.00 D in the lens plane (3.2 D in the corneal plane). This lens has a set of circular zones to split the light into two focal points (40% for far vision, 40% for near vision, and the remainder is lost in diffraction). The focus for far vision is projected on the foveola, and the focus for near vision is projected approximately 1.0 mm before the foveola[11].

Statistical Methods

The different types of IOLs were compared regarding patient satisfaction with overall vision, day vision, and uncorrected near and far vision. This was done using the Kruskal-Wallis test followed by Dunn's test. Other results are presented as descriptive statistics or in tables.

Results

Table 1 shows the results for the level of satisfaction with overall vision, day and night vision, and uncorrected near and far vision among patients implanted with different IOLs. The level of satisfaction of patients implanted with bifocal and multifocal IOLs was significantly higher than for monofocal IOLs (Kruskal-Wallis, $p<0.001$; Dunn's post-test, $p<0.05$). There was no difference between bifocal and multifocal IOLs for the level of satisfaction with overall vision, day and night vision, and uncorrected near and far vision (Dunn's post-test, $p>0.05$).

Among patients implanted with monofocal IOLs, 58.7% were male and 41.3% were female; for bifocal IOLs, 43.1% were male and 56.9% were female; for multifocal IOLs, 50% were male and 50% were female, with an even distribution between sexes (86 males and 85 females).

Figure 1 shows a significant association between the type of IOL and the ability to read small print (J2 or better) postoperatively (chi-squared test, $p<0.001$). The percentage of patients with monofocal IOLs who could read small print was significantly lower than for bifocal and multifocal IOLs (Z-test, $p<0.001$). Furthermore, the percentage of patients with bifocal IOLs who could read small print was significantly lower than for aspheric multifocal IOLs (Z-test, $p=0.002$) and for apodised multifocal IOLs (Z-test, $p<0.001$). There was no significant difference between aspheric and apodised IOLs in the ability to read small print (Z-test, $p>0.05$). Table 2 shows a significant association between the type of IOL and the ability to read a book or a newspaper (chi-squared test, $p<0.001$). The percentage of patients with monofocal IOLs who could read a newspaper or a book without glasses was significantly lower than for bifocal and multifocal IOLs (Z-test, $p<0.001$). There was no difference between bifocal and multifocal IOLs for the ability to read newspapers and books without glasses ($p>0.05$). Finally, there

Tabela 2

Assessing patients for the ability to perform the activities they performed before surgery.

IOL	Monofocal			
		Bifocal	Aspheric	Apodized
Lost the ability to perform some activity after surgery				
Yes	0,0 (n=0)	6,9 (n=5)	0,0 (n=0)	0,0 (n=0)
No	100,0 (n=63)	93,1 (n=67)	100,0 (n=16)	100,0 (n=20)
Able to read small print without glasses				
Yes	4,8 (n=3)	55,6 (n=40)	100,0 (n=16)	100,0 (n=20)
No	95,2 (n=60)	44,5 (n=32)	0,0 (n=0)	0,0 (n=0)
Able to read small print with glasses				
Yes	100,0 (n=63)	47,2 (n=34)	100,0 (n=16)	100,0 (n=20)
No	0,0 (n=0)	5,6 (n=4)	0,0 (n=0)	0,0 (n=0)
Does not wear glasses	0,0 (n=0)	47,2 (n=34)	0,0 (n=0)	0,0 (n=0)
Able to read a newspaper or book without glasses				
Yes	1,6 (n=1)	83,3 (n=60)	100,0 (n=16)	100,0 (n=20)
No	98,4 (n=62)	16,7 (n=12)	0,0 (n=0)	0,0 (n=0)
Able to make handicrafts without glasses				
Yes	3,2 (n=2)	80,6 (n=58)	100,0 (n=16)	100,0 (n=20)
No	96,8 (n=61)	19,5 (n=14)	0,0 (n=0)	0,0 (n=0)
Able to make handicrafts with glasses				
Yes	66,7 (n=42)	48,6 (n=35)	100,0 (n=16)	100,0 (n=20)
No	33,3 (n=21)	2,8 (n=2)	0,0 (n=0)	0,0 (n=0)
Does not wear glasses	0,0 (n=0)	48,6 (n=35)	0,0 (n=0)	0,0 (n=0)
Able to write cheques or fill in forms without glasses				
Yes	33,3 (n=21)	93,1 (n=67)	100,0 (n=16)	100,0 (n=20)
No	66,7 (n=42)	7,0 (n=5)	0,0 (n=0)	0,0 (n=0)
Able to write cheques or fill in forms with glasses				
Yes	98,4 (n=62)	50,0 (n=36)	100,0 (n=16)	100,0 (n=20)
No	1,6 (n=1)	0,0 (n=0)	0,0 (n=0)	0,0 (n=0)
Does not wear glasses	0,0 (n=0)	50,0 (n=36)	0,0 (n=0)	0,0 (n=0)
Able to drive during the day without glasses				
Yes	100,0 (n=63)	68,1 (n=49)	100,0 (n=16)	100,0 (n=20)
No	0,0 (n=0)	0,0 (n=0)	0,0 (n=0)	0,0 (n=0)
Does not drive	0,0 (n=0)	31,9 (n=23)	0,0 (n=0)	0,0 (n=0)
Able to drive during the night without glasses				
Yes	100,0 (n=63)	66,7 (n=48)	100,0 (n=16)	95,0 (n=19)
No	0,0 (n=0)	1,4 (n=1)	0,0 (n=0)	5,0 (n=1)
Does not drive	0,0 (n=0)	31,9 (n=23)	0,0 (n=0)	0,0 (n=0)
Managed to pass driver's licence tests				
Yes	47,6 (n=30)	23,6 (n=17)	25,0 (n=4)	10,0 (n=2)
No	7,9 (n=5)	1,4 (n=1)	6,3 (n=1)	0,0 (n=0)
Not tested yet	44,4 (n=28)	47,2 (n=34)	68,8 (n=11)	90,0 (n=18)
Does not drive	0,0 (n=0)	27,8 (n=20)	0,0 (n=0)	0,0 (n=0)

Results are shown as percentage (absolute frequency).

was a significant association between the type of IOL and the ability to make handicrafts such as sewing or embroidering (chi-squared test, $p<0.001$). The percentage of patients with monofocal IOLs who could do handicrafts without glasses was significantly lower than for bifocal and multifocal lenses (Z-test, $p<0.001$).

Discussion

All patients in this study had presbyopia, and surgery was indicated based on rigorous criteria. Patients submitted to surgery had bilateral cataract, a regular topographic image of the cornea, and astigmatism under 1 D cyl. Previous studies reported a high degree of satisfaction among patients implanted with bifocal and multifocal IOLs[12]. In this study 80.9% of patients with monofocal IOLs, 86.1% of patients with bifocal IOLs, and 100% of patients with apodised aspheric IOLs reported being satisfied or very satisfied with their overall day vision without glasses. These results are also in agreement with de Vrieset et al. Other authors[14] reported that patients with bifocal and multifocal IOLs had less visual problems than patients with monofocal IOLs, either during the day or night and without glasses, although the difference was not statistically significant when patients wore glasses. In this study, 73% of patients with monofocal IOLs, 87.5% with bifocal IOLs, 100% with aspheric IOLs, and 100% with apodised IOLs reported being satisfied or very satisfied with their night vision

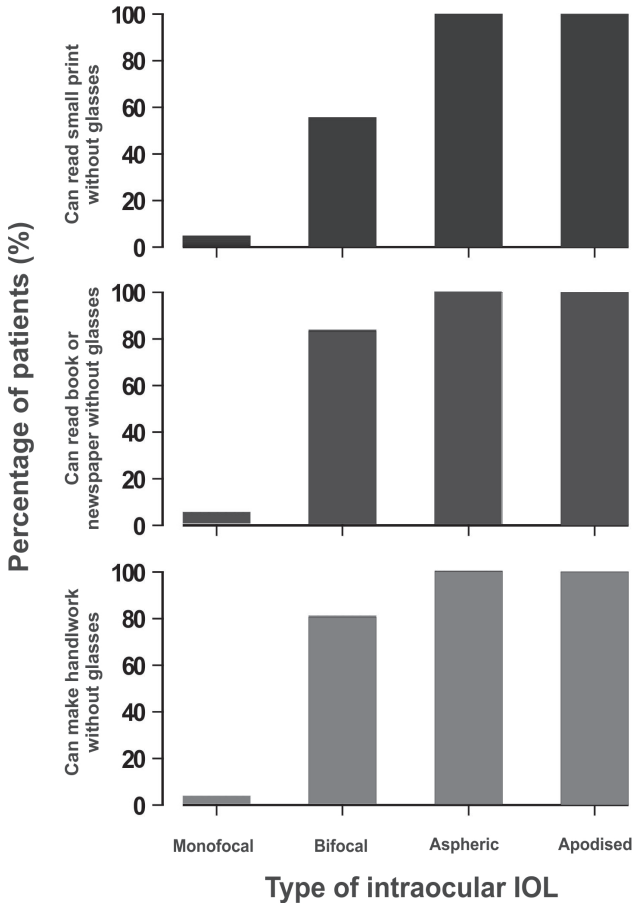

Figure 1: Percentage of patients implanted with different IOLs who could read small print, read a book or a newspaper, and make handicrafts without glasses. Columns represent percent values.

without glasses. Also, 68.2% of patients with monofocal IOLs, 88.9% with bifocal IOLs, 100% with aspheric IOLs, and 100% with apodised IOLs reported being satisfied or very satisfied with their overall vision without glasses. Furthermore, 3.2% of patients with monofocal IOLs, 84.7% with bifocal IOLs, 100% with aspheric IOLs, and 100% with apodised IOLs reported being satisfied or very satisfied with their near vision without glasses. This is in agreement with a previous study[15] where 75% of patients in the multifocal group had a J1 vision versus 10% in the monofocal group, while 95% of patients in the multifocal group achieved a visual acuity of J2 or better. Other authors[16] have shown that multifocal IOLs provide better depth of focus and high patient satisfaction, facilitating tasks that require intermediate and near vision. It has also been reported that 23.8% of patients with monofocal IOLs, 55.5% with bifocal IOLs, 56.3% with aspheric IOLs, and 40% with apodised IOLs were bothered by halos, rings or reflexes around light foci. Other authors[17,18] compared multifocal refractive IOLs with monofocal IOLs and found statistically-significant differences in visual symptoms such as halos, glare and blurred far vision. Patients reported significant improvements in these symptoms by the 6th postoperative month, probably due to neural adaptation[10]. Objective and subjective assessments showed that patients with bifocal and multifocal IOLs were more independent from glasses, with a better visual outcome and higher patient satisfaction for far, intermediate and near vision[9,12,13,16,19]. Bifocal IOLs can be a cost-effective alternative for patients in poor financial condition as they reduce the need for glasses after cataract surgery[5]. Note that it would be appropriate to apply the questionnaire more than once and at different dates. Our study was a case series, and not a randomised clinical trial. It is recommended to assess the mental health of subjects to be included in a study and to correlate the questionnaire results with objective tests of visual acuity.

Conclusion

In this study, the subjective evaluation of patients with bifocal and multifocal IOLs showed that the vast majority of subjects reported being satisfied with their overall vision, as they were able to read newspapers or books, recognise people, read traffic signs, write cheques and fill in forms, play sports, cook, watch TV, and shave or apply makeup without glasses, thus providing a good quality of life. Similar results were found for patients with monofocal IOLs but in a lesser degree, as they required glasses for near vision. Thus, multifocal IOLs were shown to be a predictable, reproducible and safe alternative for correcting near and far refractive errors, providing better quality of life and independence from glasses and enabling patients to perform daily tasks.

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