

Visual Quality in Simultaneous Bilateral Cataract Surgery by Phacoemulsification

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Abstract

Introduction: The current cataract surgery requires the restoration of vision in the highest quantity and quality possible.

Methodology: A prospective and analytical study of a series of cases was carried out in 590 patients with the diagnosis of bilateral cataract, operated by simultaneous bilateral lens surgery, treated at the Ocular Microsurgery Center of the Cuban Institute of Ophthalmology "Ramón Pando Ferrer", During the period from September 2018 to July 2020. The variables of age, sex, nuclear hardness according to LOCS III, better visual acuity with and without correction, medium induced astigmatism, color vision, contrast sensitivity and reading speed analysis. Percentages and absolute numbers were used to summarize the qualitative variables; in the case of the quantitative ones, the mean with its standard deviation (SD) and the 95% confidence interval were used.

Results: The female sex was more frequent in 68%, the mean age was 70.1 ± 7.3 years. The 53.01% of the patients had NO3 hardness. The mean of the best visual acuity without correction improved to 0.86 ± 0.23 , the BBCVA improved to 0.98 ± 0.02 ; the rest of the variables studied showed in the same way significant improvement.

Conclusions: The simultaneous bilateral cataract surgery contributes significantly to the improvement of binocular vision in quantity and quality in the same time.

Keywords: *Cataract; Simultaneous Bilateral Surgery; Visual Quality and Quality of Life*

Introduction

At present, life expectancy in countries with good health performance is increasing significantly and this condition needs to create conditions to improve the quality of life of these patients. Vision is one of the most important senses in human life, so when referring to quality of life, it must be directly related to visual quality.

The visual quality is significantly compromised with the development of the cataract that is significantly linked in its most common form to age; the solution to this visual impairment is only achieved through surgery.

In Cuba there is an increase in the life expectancy of the population, made up of 11,201,549 inhabitants, of which 20.8% are 60 years or older. Life expectancy at birth for both sexes is 78.45 years of age and is on the rise [1,2].

Cataracts are caused by opacity of the lens, with a gradual and progressive decrease in visual acuity, causing alterations in the perception of brightness and color of objects, glare from the sun and other light sources, and even diplopic [3].

Cataract surgery has evolved very positively and as phacoemulsification has been perfected, a surgical method that has shown greater reproducibility and quality of its results, has allowed this surgery to go from being a method basically to remove the cataract, to become a refractive procedure [4].

This refractive result, which is the current visual need of cataract operated patients, and is given because, although many patients are elderly, in modern society even in these stages of life, an important social and professional activity is maintained.

The constant scientific development in Ophthalmology, requires high quality personalized pre-operative examinations, by qualified personnel and using the most modern technology available, for the proper selection of the type of intraocular lens to be implanted, taking into account the needs and expectations visual of each patient, as well as a surgery without complications that is capable of correcting the previous refractive defect, hence the pre-operative questioning of the patient is very important [5].

This pre-operative evaluation is not only aimed at determining the amount of visual impairment in patients, analyzing the quantitative tests of the measurement of visual acuity, but it is necessary to evaluate their visual function by performing quantitative tests such as reading speed, the curve of blur, in addition to qualitative examinations such as aberrometry studies, analysis of contrast sensitivity, color vision.

Simultaneous bilateral cataract surgery by phacoemulsification has increased its approval among patients due to its high results in the recovery of visual quantity and quality, by restoring binocular vision in a single surgical time and therefore greater visual quality, than operated patient's cataract surgery in two times [6,7].

The phacoemulsification surgical technique plays an important role, since it is necessary to perform a refined surgery with minimal or no complications, with well-controlled phacodynamics parameters that avoid a post-operative inflammatory reaction that compromises the satisfactory evolution of the surgery, taking care of all the details related to it such as minimally invasive anesthesia, the place and size of the incision, the centering and size of the capsulorhexis and the effective placement of the intraocular lens in the capsular bag.

All these aspects that relate the personalized preoperative study, the appropriate and individualized surgical technique, the method of performing it in relation to the binocularity of the procedure, and the choice of the IOL that meets the visual needs of the patient; They complete the algorithm that guarantees to consider cataract surgery a refractive procedure due to its results that guarantee a high quality of life related to vision.

Methodology

A prospective and analytical study of a series of cases was carried out, the universe of which consisted of all patients with a diagnosis of bilateral cataract, operated by simultaneous bilateral lens surgery, treated at the Center for Ocular Microsurgery of the Cuban Institute of Ophthalmology "Ramón Pando Ferrer", during the period from September 2018 to July 2020; From which a sample of 590 patients was selected, who underwent the surgical technique of phacoemulsification by Pre Chop, with a foldable intraocular lens implant, selected from the database of the Ocular Microsurgery Center; who met the inclusion criteria, such as having simultaneous bilateral cataract surgery by phacoemulsification criteria, being over 50 years of age, having expressed their voluntary willingness to participate in the research, and having complete information on the pre and postoperative examinations required for the study.

Patients with general diseases such as: collagen diseases and immunological conditions, as well as ocular diseases such as: eyelid disorders (ectropion, entropion, palpebral ptosis), dry eye syndrome, corneal disorders (dystrophies, degenerations, keratoconus, leukoma), traumatic, complicated and pathological cataracts, glaucoma in any of its classifications, retinal and macular degenerations, congenital ocular anomalies (microcornea, aniridia, persistence of hyperplastic primary vitreous), were excluded from the study.

Patients who decided to drop out for medical and / or personal reasons exited the study.

In order to achieve the proposed objectives, the following variables were analyzed: age, sex, hardness of the lens measured by the LOCSIII classification system [8].

All patients underwent a preoperative diagnostic line, where after defining the diagnosis of bilateral cataract, parameters related to visual function were evaluated by determining the visual quantity, determining the best uncorrected visual acuity (BUVA) and best correct visual acuity (BCVA), and binocular best correct visual acuity (BBCVA), measured by the Snellen chart.

The induced mean astigmatism (IMA), analyzed with the measurements obtained from the Keratometer and corneal topographer (Pentacam AXL), in addition to the Reading Speed analyzed with the Radner Test -Vissum. The visual quality study was carried out with aberrometry, performed with the ORK-Wavefront analyzer (Schwind), Color vision with the Ishihara test, Contrast sensitivity measured with the Pelli Robson chart [9,10].

The IOL power calculation was performed, by the IOL Master 700 (Zeiss), and the formula was applied according to its measurements, the 3rd generation formulas used were SRK-T for emmetropic and myopic patients, as well as Hoffer Q for hyperopic patients, for the calculation of the IOL due to its high precision since they are based on the effective lens position respect to the plane of the cornea (ELP) to increase its accuracy.

Surgery

The surgical interventions were executed by the same expert surgeon (RM) using topical anesthesia. After the creation of a temporal corneal tunnel incision and a capsulorhexis of about 5.5 mm, the lens phacoemulsification was performed by the pre chop technique using the phaco device Revolution (Optikon), the Ocuflex brand hydrophilic acrylic foldable intraocular lens, model RYCF, and was implanted. At the end of surgery intracameral cefuroxime was injected in the anterior chamber. The corneal incisions were sealed with stromal hydration.

Each patient followed a topical antibiotic and anti-inflammatory prophylaxis and a postoperative treatment with topical steroid plus antibiotic drops (one drop four times daily for the first four days, then one drop three times daily for the following one month).

The patients were not occluded after surgery, to reduce their degree of anxiety, and well-cleaned dark glasses were placed on them for their transfer home.

Statistical analysis

Data collection was carried out using forms and they were entered into a database elaborated in SPSS version 15.0 previously elaborated by the author of the investigation where the variables under study were included. Data collection was carried out using forms and the values of the variables under study were entered into a database created in the Microsoft Excel application by the author of the research. The qualitative variables were expressed by their respective absolute (n) and relative frequencies (%), while the quantitative variables by the arithmetic mean and the standard deviation of the mean (SD), respectively. To verify the changes experienced by the variables expressed categorically, the nonparametric Chi-square (χ^2) significance test was applied between the different evaluation moments, applying the Yates correction for it. In addition, to compare the means of the quantitative variables between the different evaluation moments, the Student's t test was applied for independent variables, after checking the homogeneity and normality of the variances using the Shapiro-Wilk and Kolmogorov-Smirnov tests. On the other hand, Pearson's correlation coefficient (r) was used to evaluate the degree of correlation between continuous quantitative variables. In all cases, a level of significance was set $\alpha = 0.05$. The data were tabulated and plotted using Microsoft Excel and analyzed using the statistical program IBM SPSS Statistics v22.0, for Windows. The results are shown in

tables and figures using absolute numbers and percentages, means and DS. From the ethical point of view, the investigation was justified since it was carried out in accordance with the provisions of the National Health System and provided for in Law No. 41 of the Ministry of Public Health (MINSAP). The patient and her relatives were offered an explanation about the surgery, its importance, the benefits and drawbacks. Informed consent was obtained from patients and relatives to participate in this research.

Results

The study showed that the female sex was 68% more frequent, the mean age was 70.1 ± 7.3 years. The 53.01% of the patients had NO3 hardness according to LOCSIII.

The mean of the BUVA at the beginning of the study was 0.32 ± 0.13 ; that after surgery it improved to 0.86 ± 0.23 . In relation to the BCVA, this was 0.66 ± 0.24 , which improved one month after surgery to 0.98 ± 0.02 ; with significant changes in the evolution of the patients in both studies. ($p < 0.05$).

The pre-operative BBCVA for far, was a mean of 0.33 ± 0.16 that improved to 0.98 ± 0.02 in the postoperative period, with a statistically significant difference ($p < 0.05$). The association between the density of nuclear, cortical and posterior subcapsular lens opacities in relation to visual impairment and reading performance was evaluated.

Postoperative measurements one month after surgery were comparable with an association between lens density and visual improvement after surgery ($p < 0.05$).

The difference between postoperative reading speed analysis at one month and preoperative is representative of the vision gain related to cataract surgery and they were statistically significant.

The mean automatic keratometry (IOL Master) pre vs postoperatively, a difference of 0.08 was obtained between the start and one month after surgery, finding that it was not statistically significant ($p > 0.05$), so astigmatism was not induced with surgery.

The means of the corneal curvature radii measured by topography with Pentacam AXL between the pre-operative period and the month after the operation, showed a difference of 0.07 between the beginning and one month after the operation, with no statistically significant changes ($p > 0.05$).

The comparison of the means of the corneal curvature radii measured by topography with Pentacam AXL with respect to automatic keratometry (IOL Master), showed that there were no significant differences between the two, as there was a strong correlation between the values obtained independently for each patient, where the value Pearson's correlation coefficient was 0.999 before surgery and 0.958 one month after surgery.

That is, the results of the means of the corneal curvature radii measured by both methods do not differ significantly. The degree of relationship between the induced astigmatism values obtained by topography with Pentacam AXL and the automatic keratometry (IOL Master) for each patient showed that there was a strong correlation, with a Pearson correlation coefficient $r > 0.9$, with very good agreement in both. ICC values were 0.948 and 0.901, respectively.

The mean refractive cylinder behaved with a highly significant variation of 0.55D ($p < 0.01$), between pre-operative and thirty days after surgery. The high and low order corneal aberrations, when comparing the means of the totals, showed a significant reduction of 0.15.

Before surgery, most of the patients had poor color vision, identifying ≤ 20 cards, and after one month 94.2% of the patients recovered, reading more than 25 cards. In relation to contrast sensitivity at the end of the study at one month, 92.11% of the patients were well with

values of ≥ 1.65 . The modification of the quality of life of the patients, related to the visual capacity, showed a significant change, if the pre and postoperative results are compared; which shows that a personalized preoperative study with the implantation of an IOL according to the visual needs of the patients, and performed under simultaneous bilateral surgery.

Discussion

The aforementioned results show that bilateral surgery of the lens at the same time by Phacoemulsification, when correctly planned and indicated, can show very favorable refractive results that allow satisfying the visual needs of patients to undertake the activities of their daily life and improve their quality of life.

This study agrees with other investigations that report that elderly patients are mostly the tributaries of this surgery [6,7,9]. The hardness of the lens measured by LOCSIII for this study, like others consulted, shows the highest percentages in patients grouped in nuclear opacities of the lens (NO) from 3 to 5 [8,13,14].

The ideal time to perform bilateral cataract surgery at the same time is always under discussion, since the aim is to restore binocular vision in a single surgical time, but the visual deficit to determine this time depends on the individualities of each patient, since it is constantly changing as younger patients with better visual acuity are operated on.

The evaluation of the visual quantity included the determination of the visual deficit in monocular vision for far and near, as well as the BCVA of distance. The recovery of the BCVA, BUVA and BBCVA, in the group of patients studied was the maximum; reinforcing the criterion of improvement of the visual quantity as in other studies evaluated [4,7,11,15].

By recovering all these parameters related to visual quantity, between the pre-operative period and the control one month after surgery, he showed that there is a significant recovery in reading performance, regardless of the cultural level of the patient, by increasing the reading speed by vision gain, as reported by Talavero González P. [9] and Alió J., *et al* [10].

When analyzing the parameters related to visual quality, it must be taken into account that this can be altered in the initial stages of the cataract, even when the visual quantity is the maximum. For this reason, the quantity and visual quality must be analyzed together to decide the ideal time for surgery, according to the needs of each patient. In this study, the induced mean astigmatism showed that it had a minimum value, at the end of the surgical process with its final measurement one month after surgery; This measurement was crossed by obtaining it from different measurement methods such as the automatic one and that of the Pentacam AXL surveyor, as well as its relationship with the aberrometric study carried out with the ORK-Wavefront analyzer (Schwind), all the studies together demonstrate the quality of the studies pre-operative surgery, the choice of the appropriate, minimally invasive surgical technique, an impeccable surgery, as well as the exact personalized place to approach the eye of each patient.

The AMI plays an important role in the final visual quality of the patient, in addition to his aspiration to the independence of glasses, as does the opinion of the studies of Hernández Silva JR., *et al*. [6], Mateo Garbas J. [16], Castillejos Santos A. [17] and Hernández Ramos H [7,11,12].

Other studies that reinforce the criterion of gain in visual quality after cataract surgery, are the determination of color vision and contrast sensitivity, these two aspects are altered early in the vision of patients with cataracts. In fact, they are the justification for undertaking surgery in its initial stages, especially in patients whose work includes high visual quality such as surgeons, artists, especially painters, musicians, and airplane pilots, among others.

For this investigation, both conditions recovered satisfactorily one month after surgery, in the same way as reported by Richman J., *et al* [18], Mooney, S. W. J., *et al* [19] and Díaz Calvo FS [20].

By managing to recover the quantity and visual quality of these patients after simultaneous bilateral cataract surgery, there is a recovery in quality of life in relation to visual function, as this research showed, the patients surveyed with the FV-14 questionnaire, They recovered their validity and self-sufficiency, reducing the possibility of domestic or social accidents and increasing the degree of patient satisfaction, which leads to a better quality of life. Similar results were found by Hernández Ramos H. et al [11], Milanés Armengol AR., et al. [21], Trujillo Fonseca KM., et al. [22] and Rodríguez Suárez B., et al. [2,3].

At present, the scientific development of Ophthalmology has been aimed at satisfying the visual needs of patients, who every day, motivated by professional and social demands, demand the greatest possible independence from glasses after cataract surgery; hence, new models of intraocular lenses are constantly being included in medical practice capable of satisfying the needs.

Bibliography

1. Ministerio de Salud Pública. Anuario Estadístico de Salud 2019. La Habana: Dirección Nacional de Estadística (2020).
2. World Health Organization (WHO). WHO Launches First Global Vision Report Geneva: WHO (2019).
3. Bourne RRA., et al. "Vision Loss Expert Group. Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: a systematic review and meta-analysis". *Lancet Global Health* 5.9 (2017): 888-897.
4. Hernández Silva JR. "Facochoy en la faco Premium". En: Centurión V, Nicoli C, Chávez Mondragón E. *Cristalino de las Américas. La cirugía del cristalino hoy. 2da edition. Editorial Jaypee Highlights Medical Publishers, Inc". India (2015): 521-527.*
5. Veitía Z., et al. "Estudios preoperatorios en la cirugía de catarata". En: Río Torres M., Capote Cabrera A., Hernández Silva JR., Eguías Martínez F., Padilla González CM. *Oftalmología. Criterios y tendencias actuales". La Habana: Editorial Ciencias Médicas (2009): 203-222.*
6. Hernández Silva JR., et al. "Facoemulsificación bilateral secuencial inmediata. En: Río Torres M., Fernández Argones L., Hernández Silva JR., Ramos López M. *Manual de Diagnóstico y Tratamiento en Oftalmología. La Habana: Editorial Ciencias Médicas (2017): 184-189.*
7. Hernández Ramos H., et al. "Evaluación de la efectividad en la cirugía de catarata por Facoemulsificación bilateral simultánea versus Facoemulsificación bilateral secuencial". *Revista Cubana Oftalmología* 32.2 (2019): 15.
8. Hernández Silva JR., et al. "Estudio densitométrico del cristalino y su relación con el sistema LOCS III". *Revista Cubana de Oftalmología* 26.2 (2013): 191-197.
9. Talavera González P. "Análisis de la función y la calidad visual tras cirugía de catarata con implante de lente intraocular multifocal. Tesis doctoral. Universidad Complutense de Madrid". *Facultad de Medicina (2019).*
10. Alió JL., et al. "Design of short Spanish sentences for measuring reading performance". *The Journal of Cataract and Refractive Surgery* 34.4 (2008): 638-642.
11. Hernández Ramos H., et al. "Calidad de vida y visual en pacientes operados de catarata por Facoemulsificación bilateral simultánea con implante de lente intraocular". *Revista Cubana Oftalmología* 32.2 (2019): 17.
12. Endophthalmitis Study Group, European Society of Cataract and Refractive Surgeons. Prophylaxis of postoperative endophthalmitis following cataract surgery: results of the ESCRS multicenter study and identification of risk factors". *Journal of Cataract and Refractive Surgery* 33.6 (2007): 978-988.

13. Díaz Calvo FS. "Calidad de vida relacionada con la visión, utilidades en salud y efectividad de la facoemulsificación en pacientes con catarata. [Tesis doctoral]. Departamento de ciencias socio sanitarias de la facultad de medicina. Universidad de Murcia". España (2013).
14. Ibáñez González MI. "Resultados clínicos y calidad de vida en pacientes intervenidos de cataratas con implantación de una nueva lente intraocular multifocal. Escuela internacional de doctorado. Programa de Doctorado en Ciencias Sociales y de la Salud". Universidad Católica de Murcia. España (2017).
15. Luján Paredes S., *et al.* "Variación de la función visual y calidad de vida luego de cirugía de catarata por facoemulsificación con implante de lente intraocular". *Revista Mexicana de Oftalmología* 88.4 (2014): 176-181.
16. Mateo Garbas J. "Tratamiento del astigmatismo moderado en pacientes con cataratas. Tesis doctoral. Universidad de Zaragoza. Facultad de medicina. Departamento de Cirugía, Ginecología y Obstetricia". Zaragoza (2013).
17. Castillejos Santos A. "Variación del astigmatismo corneal inducido por cirugía de catarata en función de la incisión límbica. Trabajo final de Máster Universitario en Optometría y Ciencias de la Visión. Facultad de Óptica y Optometría de Terrassa". Universidad Politécnica de Cataluña (2015).
18. Richman J., *et al.* "Contrast sensitivity basics and a critique of currently available test". *The Journal of Cataract and Refractive Surgery* 39 (2013): 1100-1106.
19. Mooney SWJ., *et al.* "A tool for rapid measurement of contrast sensitivity based on smooth eye movements". *Journal of Vision* 18.12 (2018): 1-19.
20. Díaz Calvo FS. "Calidad de vida relacionada con la visión, utilidades en salud y efectividad de la facoemulsificación en pacientes con catarata. [Tesis doctoral]. Departamento de ciencias socio sanitarias de la facultad de medicina. Universidad de Murcia". España (2013).
21. Milanés Armengol AR., *et al.* "Cirugía de catarata en pacientes longevos: repercusión sobre su calidad de vida y funcionalidad". *Medisur* 10.5 (2012): 386-392.
22. Trujillo Fonseca KM., *et al.* "Calidad visual y calidad de vida en pacientes operados de catarata mediante Facoemulsificación". *Revista Cubana Oftalmología* 32.1 (2019): 15.
23. Rodríguez Suárez B., *et al.* "Calidad de vida relativa a la visión según estudios psicofísicos en pacientes hipermétropes con cirugía fcorrefractiva". *Revista Cubana Oftalmología* 31.2 (2018): 16.
24. Carreño E., *et al.* "Refractive and Visual Outcomes after Bilateral Implantation of a Trifocal Intraocular Lens in a Large Population". *Clinical Ophthalmology* 14 (2020): 369-376.

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