DOI: https://doi.org/10.17816/OV79105
Research article

Visual acuity and quality of life in heavy visual workload patients with bilateral cataract before and after phacoemulsification

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BACKGROUND: To date, there is a number of debatable aspects of cataract phacoemulsification in the literature, one of which is the investigation of features of the surgery in patients with visually stressful work.

AIM: The aim is to investigate the dynamics of the best corrected distance visual acuity and quality of life in heavy visual workload patients with bilateral cataract before and after phacoemulsification.

MATERIALS AND METHODS: We observed 32 heavy visual workload patients with binocular cataracts. All patients underwent standard phacoemulsification using Infiniti (Alcon, USA) or Constellation (Alcon, USA) devices according to the standard technique. The quality of life was assessed using the tested in refractive surgery QOL-25 questionnaire.

RESULTS: The high efficiency of phacoemulsification surgery was established, which is confirmed (14 days after the second procedure) by an increase in best corrected distance visual acuity to an average value of 0.92–0.95 relative units. Along with this, a certain quality of life dynamics of was revealed, which is manifested by a statistically significant deterioration (by 2.3–4.7%, p = 0.02–0.008) in the index in 14 and 21 days after the first surgical procedure compared to the data obtained at 7 days after first operation.

CONCLUSION: Surgical treatment of binocular cataracts in heavy visual workload patients is based on earlier (in 7–10 days) surgery on the second eye or performing an immediately sequential bilateral cataract surgery.

Keywords: cataract; heavy visual workload; quality of life; anisometropia; phacoemulsification.

To cite this article:
Pokrovsky DF, Ovechkin NI. Visual acuity and quality of life in heavy visual workload patients with bilateral cataract before and after phacoemulsification. *Ophthalmology Journal*. 2021;14(4):7-12. DOI: https://doi.org/10.17816/OV79105

Received: 25.08.2021 **Accepted:** 12.11.2021 **Published:** 29.12.2021

DOI: https://doi.org/10.17816/OV79105
Научная статья

Острота зрения и качество жизни пациентов зрительно-напряжённого труда с двусторонней катарактой до и после факоэмульсификации

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Актуальность. К настоящему времени в литературе существует ряд дискуссионных аспектов проведения факоэмульсификации катаракты, одним из которых является исследование особенностей проведения операции у пациентов зрительно-напряжённого труда.

Цель — исследование динамики максимально корригируемой остроты зрения вдаль и качества жизни пациентов зрительно-напряжённого труда с двусторонней катарактой до и после факоэмульсификации.

Материалы и методы. Под нашим наблюдением находилось 32 пациента зрительно-напряжённого труда с бинокулярной катарактой. Всем пациентам была выполнена стандартная факоэмульсификация катаракты с помощью аппаратов Infiniti (Alcon, США) или Constellation (Alcon, США) по стандартной методике. Качество жизни оценивали с помощью апробированного в рефракционной хирургии опросника «Качество жизни-25».

Результаты. Установлена высокая эффективность проведения факоэмульсификации, что подтверждается (через 14 дней после второй операции) повышением максимально корригируемой остроты зрения до средней величины 0,92–0,95 отн. ед. Наряду с этим выявлена определённая динамика качества жизни, что проявляется его статистически значимым ухудшением после первой операции через 14 и 21 день (на 2,3–4,7 %, p = 0,02–0,008) в отличие от данных, полученных через 7 дней.

Заключение. Хирургическое лечение бинокулярной катаракты у пациентов зрительно-напряжённого труда основывается на более раннем (7–10 дней) проведении операции на втором глазу или выполнении одномоментной бинокулярной факоэмульсификации.

Ключевые слова: катаракта; зрительно-напряжённый труд; качество жизни; анизометропия; факоэмульсификация.

Как цитировать:
Покровский Д.Ф., Овечкин Н.И. Острота зрения и качество жизни пациентов зрительно-напряжённого труда с двусторонней катарактой до и после факоэмульсификации // Офтальмологические ведомости. 2021. Т. 14. № 4. С. 7–12. DOI: https://doi.org/10.17816/OV79105

Рукопись получена: 25.08.2021 **Рукопись одобрена:** 12.11.2021 **Опубликована:** 29.12.2021

ЭКО•ВЕКТОР

BACKGROUND

Cataract is one of the most urgent forms of eye pathologies, with an overall prevalence in the Russian Federation of 3.36% for the urban population and 3.63% for the rural population. According to a mathematical model, the prognosis of the prevalence of patients with mature cataract in different age groups will account for 11%–13% of the general population in the coming years. Cataract is also one of the major causes of reversible ablepsia and impaired vision [1–3]. The gold standard of cataract surgery is phacoemulsification (PE), and its practical application has been widely tested and regulated in the practice of both Russian [4] and international ophthalmologists [5, 6]. To date, several aspects of PE are debatable in the literature [7–10], one of which is the study of the surgical characteristics in patients with heavy visual workload (HVW) [11]. In addition, the inclusion of the quality of life (QoL) assessment in the complex of standard clinical and functional methods for examining the eyes of a patient with cataracts is highly efficient [12–14].

This work aimed to analyze the dynamics of visual acuity and QoL in patients HVW and bilateral cataract before and after PE.

MATERIALS AND METHODS

We monitored 32 patients (26 men, 6 women) aged 37–65 (mean age, 54.7 ± 1.4) years who met the following inclusion criteria:

- Daily activities were characterized as HVW using a personal computer, such as financial and scientific workers, proofreaders, etc.
- Binocular cataract with a visual acuity in the "best" eye of no more than 0.6, which corresponded to the recommendations justifying surgical treatment of cataracts in patients with HVW at an earlier stage [11].
- Absence of other eye pathologies and systemic somatic diseases.
- Surgery on the fellow eye three weeks after the first surgery (for paramedical reasons).

All patients underwent standard PE using Infiniti (Alcon, TX, USA) or Constellation (Alcon) devices according to the standard technique through a 2.2-mm corneal incision with a meridional direction according to the refractive map of the cornea; in all patients, procedures were performed by the same surgeon (D. F. Pokrovsky). For aphakia correction, monofocal intraocular lenses Acrysof Natural IQ (Alcon), Akreos AO (Bausch + Lomb, Bridgewater, NJ, USA), and Biflex (Medicontur, Hungary) were implanted. Biometrics and calculation of intraocular lenses were performed using an optical biometer IOL Master (Carl Zeiss, Germany).

The best-corrected distance visual acuity (BCVA) was evaluated according to the standard method using a SC-1700 chart panel and a phoropter (Nidek, Japan). Refraction was assessed using an HRK-7000 instrument (Huvitz, South Korea) before and after surgery. In this case, the "target" refraction was ±0.5 diopters. QoL was assessed using the "QoL-25" questionnaire widely tested in refractive surgery, which includes 25 questions in the main areas of professional and everyday visual activity; this tool can be used as a quantitative integral indicator based on the weight coefficients of each of the patient's answers. The total test indicator was estimated [15]. This questionnaire was selected given that, at present, cataract surgery, in terms of the quality of vision of the patient after PE, can be referred to as a refractive intervention, which is associated with the implementation of new technologies in ophthalmic surgery and development of high-quality intraocular lenses [16]. Patients were examined before the first surgery; 7, 14, and 21 days after the first surgery; and 7 and 14 days after the second surgery.

Statistical analysis of the study results was performed using the Statistica 8.0 software application (StatSoft, Inc., USA) based on the use of standard parametric methods for estimating the mean and error of the mean value of the indicator ($M \pm m$), as well as Student's t-test.

RESULTS

In the analysis of the clinical findings of patients after PE, no postoperative infectious complications were noted. Tables 1 and 2 and Figure 1 present the research results.

DISCUSSION

PE demonstrated a high clinical efficiency, which is confirmed (14 days after the second surgery) by an increase in BCVA, with an average of 0.92–0.95 rel. units

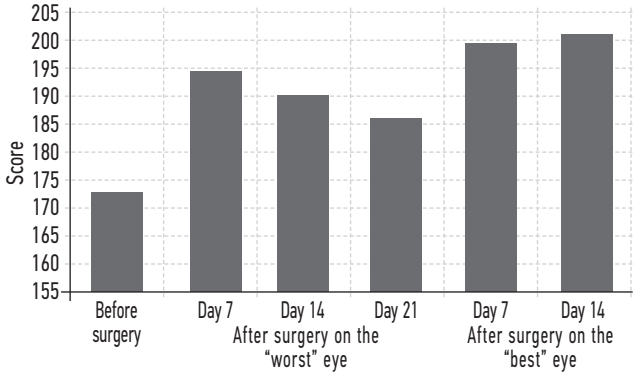

Figure. The results of the investigation of the quality of life dynamics in a patient before and after phacoemulsification

Рисунок. Результаты исследования динамики качества жизни пациента до и после проведения факоэмульсификации катаракты

Table 1. Results of the best corrected distance visual acuity (BCVA) dynamics before and after phacoemulsification, *M* ± *m*

Таблица 1. Результаты исследования динамики максимально корригируемой остроты зрения вдаль (МКОЗ) у пациентов до и после проведения факоэмульсификации катаракты, *M* ± *m*

BCVA, rel. units	"Worst" eye	"Best" eye	*p**
Before surgery	0.18 ± 0.04	0.56± 0.04	0.0008
	After surgery 1		
Day 7	0.78 ± 0.06	0.56 ± 0.04	0.006
Day 14	0.89 ± 0.06	0.56 ± 0.04	0.004
Day 21	0.94 ± 0.06	0.56 ± 0.04	0.0006
	After surgery 2		
Day 7	0.95 ± 0.05	0.80 ± 0.05	0.02
Day 14	0.95 ± 0.05	0.92 ± 0.05	0.25

* *p* — level of confidence between the "worst" and "best" eye.

Table 2. Results of refraction testing before surgery and deviations from target refraction in patients after phacoemulsification, *M* ± *m*

Таблица 2. Результаты исследования рефракции до операции и отклонения от целевой рефракции у пациентов после проведения факоэмульсификации катаракты, *M* ± *m*

Parameter	"Worst" eye	"Best" eye
Refraction before surgery, diopter	–2.41 ± 0.21	–1.95 ± 0.26
Deviation from the target refraction after the first surgery, diopter		
Day 7	0.22 ± 0.05	–
Day 14	0.25 ± 0.04	–
Day 21	0.27 ± 0.04	
Deviation from the target refraction after the second surgery, diopter		
Day 7	0.26 ± 0.04	0.22 ± 0.05
Day 14	0.26 ± 0.05	0.27 ± 0.04

and QoL up to 201.4 points, which represent maximum values. In all cases, a minimum deviation of 0.22–0.27 diopters was noted from the "target" refraction. Moreover, data indicated a certain dynamics of QoL, which is manifested by its significant deterioration after 14 and 21 days from the first surgery (by 2.3%–4.7%, $p = 0.02–0.008$) compared with data obtained within 7 days. The changes can be due to a pronounced difference in the visual acuity of both eyes, which at this period averaged from 0.33 to 0.38 rel. units.

In the analysis of the literature, targeted studies indicated the negative effect of anisometropia and aniseikonia in patients with binocular cataract after surgery on the "worst" eye [17–19]. In addition, the results of optical modeling [11] and basic studies of the psychophysiology of vision indicate the maximum allowable value in the difference in the visual acuity of both eyes (0.2–0.3 rel. units) [20].

From the current situation to the practice of cataract surgery, sequential surgical intervention with a time interval between surgeries of 7–10 days appears appropriate in patients with HVW and binocular cataract. Moreover, in our opinion, one-stage binocular phacoemulsification should be considered an alternative option [21–23] compared with the traditional monocular one, when surgery on the fellow eye is performed after certain periods, often quite long due to various reasons, which, according to the results presented, may be a risk factor for a decrease in QoL and visual performance.

CONCLUSION

Surgical treatment of patients with HVW and binocular cataract is based on an earlier (7–10 days) surgery on the fellow eye or simultaneous binocular PE, taking into account the QoL, particularly in patients with HVW.

ADDITIONAL INFORMATION

Author contributions. All authors confirm that their authorship complies with the ICMJE criteria. All of them have made a significant contribution to the development of the concept, as well as research, and preparation of the article. They have read and approved the final version before its publication. Specific contributions were as follows: D.F. Pokrovsky developed the concept and design

of the study and prepared the final draft of the article for publication. N.I. Ovechkin developed the concept and design of the study and collected the data.

Conflict of interest. The authors declare no conflict of interest.

Funding. The study had no external funding.

REFERENCES

1. Orlova OM, Trubilin VN, Zudenkov KV. Analysis of cataract progression in Russia based on the natural mortality data. *Practical medicine*. 2016;(2–1):70–73. (In Russ.)

2. Branchevsky SL, Malyugin BE. Incidence of visual impairment due to cataract according to the RAAB study in Samara. *Fyodorov Journal of Ophthalmic Surgery*. 2013;(3):82–85. (In Russ.)

3. Bourne RR, Stevens GA, White RA, et al. Causes of vision loss worldwide, 1990–2010: a systematic analysis. *Lancet.* 2013;1(6): e339–e349. DOI: 10.1016/S2214–109X(13)70113-X

4. OOO Mezhregional'naya assotsiatsiya vrachei-oftal'mologov. *Federal'nye klinicheskie rekomendatsii po okazaniyu oftal'mologicheskoi pomoshchi patsientam s vozrastnoi kataraktoi. Ehkspertnyi sovet po probleme khirurgicheskogo lecheniya katarakty*. Moscow: Oftal'mologiya, 2015. 32 p. (In Russ.)

5. Mahmud I, Kelley T, Stowell C, et al. A Proposed Minimum Standard Set of Outcome Measures for Cataract Surgery. *JAMA Ophthalmol.* 2015;133(11):1247–1252. DOI: 10.1001/jamaophthalmol.2015.2810

6. Hashemi H, Seyedian MA, Mohammadpour M. Small pupil and cataract surgery. *Curr Opin Ophthalmol*. 2015;26(1):3–9. DOI: 10.1097/ICU.0000000000000116

7. Potyomkin VV, Ageeva EV. Zonular instability in patients with pseudoexfoliative syndrome: the analysis of 1000 consecutive phacoemulsifications. *Ophthalmology Journal*. 2018;11(1):41–46. (In Russ.) DOI: 10.17816/OV11141-46

8. Potyomkin VV, Goltsman EV. Cataract surgery in pseudoexfoliation syndrome. *Ophthalmology Journal*. 2020;13(1):37–42. (In Russ.) DOI: 10.17816/OV25739

9. Alekseev IB, Khatsukova BN, Soshina MM, et al. Fixed combination bimatoprost-timolol in prevention of ocular hypertension after phacoemulsification of uncomplicated cataract. *Ophthalmology Journal*. 2016;9(2):69–73. (In Russ.) DOI: 10.17816/OV9269-73

10. Astakhov SY, Tkachenko NV. Trehalose efficacy in dry eye syndrome treatment after phacoemulsification. *Ophthalmology Journal*. 2016;9(4):79–89. (In Russ.) DOI: 10.17816/OV9479-89

11. Orlova OM. *Kompleksnaya otsenka ehffektivnosti rannei khirurgii katarakty u patsientov zritel'no-napryazhennogo truda* [dissertation]. Moscow, 2017. (In Russ.)

12. Kirwan C, Lanigan B, O'Keefe MJ. Vision-related quality of life assessment using the NEI-VFQ-25 in adolescents and young adults with a history of congenital cataract. *Pediatr Ophthalmol Strabismus.* 2012;49(1):26–31. DOI: 10.3928/01913913-20110517-02

13. He L, Cui Y, Tang X, et al. Changes in visual function and quality of life in patients with senile cataract following phacoemulsification. *Ann Palliat Med.* 2020;9(6):3802–3809. DOI: 10.21037/apm-20-1709

14. Lundström M, Pesudovs KJ. Questionnaires for measuring cataract surgery outcomes. *Cataract Refract Surg.* 2011;37(5):945–959. DOI: 10.1016/j.jcrs.2011.03.010

15. Trubilin VN, Ovechkin IG, Pozharitsky MD, et al. The study of quality of life after excimer laser operations. *Sovremennaya optometriya*. 2012;(5):39–43. (In Russ.)

16. Maliugin BÉ. State-of-the-art cataract surgery and intraocular optical correction. *The Russian annals of ophthalmology*. 2014;130(6):80–88. (In Russ.)

17. Talukder AK, Zakia S, Khanam M, et al. Binocular Visual Discomfort after First Eye Cataract Surgery: An Inattentive Burning Issue. *Mymensingh Med J.* 2019;28(2):302–305.

18. Rutstein RP, Fullard RJ, Wilson JA, Gordon A. Aniseikonia induced by cataract surgery and its effect on binocular vision. *Optom Vis Sci.* 2015;92(2):201–207. DOI: 10.1097/OPX.0000000000000491

19. Krarup TG, Nisted I, Christensen U, et al. The tolerance of anisometropia. *Acta Ophthalmol.* 2020;98(4):418–426. DOI: 10.1111/aos.14310

20. Volkov VV. Psikhofiziologiya zritel'nogo protsessa i metody ego izucheniya. *Klinicheskaya fiziologiya zreniya*. Moscow: Rusomed, 1993. P. 158–179. (In Russ.)

21. Lansingh Van C, Eckert KA, Strauss G. Benefits and risks of immediately sequential bilateral cataract surgery: a literature review. *Clin Experimental Ophthalmol* 2015;43(7):666–672. DOI: 10.1111/ceo.12527

22. Lee E, Balasingam B, Mills EC, et al. A survey exploring ophthalmologists' attitudes and beliefs in performing Immediately Sequential Bilateral Cataract Surgery in the United Kingdom. *BMC Ophthalmol.* 2020;20:210. DOI: 10.1186/s12886-020-01475-0

23. Rönbeck M, Lundström M, Kugelberg M. Study of possible predictors associated with self-assessed visual function after cataract surgery. *Ophthalmology.* 2011;118(9):1732–1738. DOI: 10.1016/j.ophtha.2011.04.013

СПИСОК ЛИТЕРАТУРЫ

1. Орлова О.М., Трубилин В.Н., Жуденков К.В. Анализ прогрессирования катаракты в России с учётом данных естественной смертности населения // Практическая медицина. 2016. № 2–1. С. 70–73.

2. Брачевский С.Л., Малюгин Б.Э. Распространённость нарушения зрения вследствие катаракты по данным исследования RAAB в Самаре // Офтальмохирургия. 2013. № 3. С. 82–85.

3. Bourne R.R., Stevens G.A., White R.A., et al. Causes of vision loss worldwide, 1990–2010: a systematic analysis // Lancet. 2013. Vol. 1. No. 6. P. e339–e349. DOI: 10.1016/S2214-109X(13)70113-X

4. ООО Межрегиональная ассоциация врачей-офтальмологов. Федеральные клинические рекомендации по оказанию офтальмологической помощи пациентам с возрастной катарактой. Экспертный совет по проблеме хирургического лечения катаракты. Москва: Офтальмология, 2015. 32 с.

5. Mahmud I., Kelley T., Stowell C., et al. A Proposed Minimum Standard Set of Outcome Measures for Cataract Surgery // JAMA Ophthalmol. 2015. Vol. 133. No. 11. P. 1247–1252. DOI: 10.1001/jamaophthalmol.2015.2810
6. Hashemi H., Seyedian M.A., Mohammadpour M. Small pupil and cataract surgery // Curr Opin Ophthalmol. 2015. Vol. 26. No. 1. P. 3–9. DOI: 10.1097/ICU.0000000000000116
7. Потёмкин В.В., Агеева Е.В. Нестабильность связочного аппарата хрусталика у пациентов с псевдоэксфоллиативным синдромом: анализ 1000 последовательных факоэмульсификаций // Офтальмологические ведомости. 2018. Т. 11, № 1. С. 41–46. DOI: 10.17816/OV11141-46
8. Потёмкин В.В., Гольцман Е.В. Хирургия катаракты при псевдоэксфолиативном синдроме // Офтальмологические ведомости. 2020. Т. 13, № 1. С. 37–42. DOI: 10.17816/OV25739
9. Алексеев И.Б., Хацукова Б.Н., Сошина М.М., и др. Применение фиксированной комбинации биматопроста с тимололом для профилактики офтальмогипертензии после ультразвуковой факоэмульсификации неосложнённой катаракты // Офтальмологические ведомости. 2016. Т. 9, № 2. С. 69–73. DOI: 10.17816/OV9269-73
10. Астахов С.Ю., Ткаченко Н.В. Эффективность трегалозы в лечении синдрома «сухого глаза» после факоэмульсификации // Офтальмологические ведомости. 2016. Т. 9, № 4. С. 79–89. DOI: 10.17816/OV9479-89
11. Орлова О.М. Комплексная оценка эффективности ранней хирургии катаракты у пациентов зрительно-напряжённого труда: дис. ... канд. мед. наук. Москва, 2017.
12. Kirwan C., Lanigan B., O'Keefe M.J. Vision-related quality of life assessment using the NEI-VFQ-25 in adolescents and young adults with a history of congenital cataract // Pediatr Ophthalmol Strabismus. 2012. Vol. 49. No. 1. P. 26–31. DOI: 10.3928/01913913-20110517-02
13. He L., Cui Y., Tang X., et al. Changes in visual function and quality of life in patients with senile cataract following phacoemulsification // Ann Palliat Med. 2020. Vol. 9. No. 6. P. 3802–3809. DOI: 10.21037/apm-20-1709
14. Lundström M., Pesudovs K.J. Questionnaires for measuring cataract surgery outcomes // Cataract Refract Surg. 2011. Vol. 37. No. 5. P. 945–959. DOI: 10.1016/j.jcrs.2011.03.010
15. Трубилин В.Н., Овечкин И.Г., Пожарицкий М.Д. Исследование качества жизни после эксимерлазерных операций // Современная оптометрия. 2012. № 5. С. 39–43.
16. Малюгин Б.Э. Хирургия катаракты и интраокулярная коррекция на современном этапе развития офтальмохирургии // Вестник офтальмологии. 2014. Т. 130, № 6. С. 80–88.
17. Talukder A.K., Zakia S., Khanam M., et al. Binocular Visual Discomfort after First Eye Cataract Surgery: An Inattentive Burning Issue // Mymensingh Med J. 2019. Vol. 28. No. 2. P. 302–305.
18. Rutstein R.P., Fullard R.J., Wilson J.A., Gordon A. Aniseikonia induced by cataract surgery and its effect on binocular vision // Optom Vis Sci. 2015. Vol. 92. No. 2. P. 201–207. DOI: 10.1097/OPX.0000000000000491
19. Krarup T.G., Nisted I., Christensen U., et al. The tolerance of anisometropia // Acta Ophthalmol. 2020. Vol. 98. No. 4. P. 418–426. DOI: 10.1111/aos.14310
20. Волков В.В. Психофизиология зрительного процесса и методы его изучения // Клиническая физиология зрения. Москва: Русомед, 1993. С. 158–179.
21. Lansingh Van C., Eckert K.A., Strauss G. Benefits and risks of immediately sequential bilateral cataract surgery: a literature review // Clin Experimental Ophthalmol. 2015. Vol. 43. No. 7. P. 666–672. DOI: 10.1111/ceo.12527
22. Lee E., Balasingam B., Mills E.C., et al. A survey exploring ophthalmologists' attitudes and beliefs in performing Immediately Sequential Bilateral Cataract Surgery in the United Kingdom // BMC Ophthalmol. 2020. Vol. 20. P. 210. DOI: 10.1186/s12886-020-01475-0
23. Rönbeck M., Lundström M., Kugelberg M. Study of possible predictors associated with self-assessed visual function after cataract surgery // Ophthalmology. 2011. Vol. 118. No. 9. P. 1732–1738. DOI: 10.1016/j.ophtha.2011.04.013

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