

Comparison of Different Presbyopia Treatments: Refractive Lens Exchange with Multifocal Intraocular Lens Implantation Versus LASIK Monovision

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ABSTRACT

There are several methods for presbyopia treatment. Refractive lens exchange (RLE) followed by multifocal intraocular lens (MFIOL) implantation enables high rate of spectacle independence but have some visual disturbances. Laser in Situ Keratomileusis (LASIK) monovision gives patient ability to have good distant vision with dominant eye and good near vision with nondominant eye. In this prospective randomized study we wanted to compare clinical outcomes in patients who underwent either of the mentioned procedures. The first group included 50 patients (N=100 eyes) who underwent RLE with MFIOL implantation and the second group included 50 patients (N=100 eyes) who underwent LASIK monovision as presbyopia treatment. Uncorrected distant, near and intermediate visual acuity, patient's subjective satisfaction and visual disturbances were measured. Follow up was 6 months. Patients in RLE group had better near uncorrected visual acuity (UCVA) and patients in LASIK monovision group had better distant and intermediate vision. Patients in RLE group reported visual disturbances (halo, glare). Patients satisfaction and spectacle independence was high in both groups. Refractive lens exchange with multifocal intraocular lens implantation and LASIK monovision are effective methods for presbyopia treatment. LASIK monovision with $-0.50D - 1.25D$ of residual dioptry at nondominant eye in patients under 50 years enables good vision at all distances without affecting stereovision. Patient selection and preoperative counseling are key to success.

Abbreviations: RLE – refractive lens exchange, MFIOL – multifocal intraocular lens, LASIK – laser in situ keratomileusis, UCVA – uncorrected visual acuity, IOL – intraocular lens.

Key words: *presbyopia, multifocal lenses, LASIK, monovision*

Introduction

Presbyopia is the most common refractive disorder of later life, related to decrease of accommodative amplitude. In emmetropes and hyperopes, it is usually manifested at 40 years of age by the need for reading glasses or contact lenses. Although myopes benefit at this age because of their shortsightedness, their accommodative amplitude also diminishes with age in a more or less regular manner¹. The possibility of »curing« or reducing the effects of presbyopia is intensively investigated in modern ophthalmology. In the past, the usual remedy was to wear reading glasses or special multifocal lenses (bifocal or progressive) for presbyopia. But in modern times, sur-

gical remedies for presbyopia are also available for qualified candidates². In everyday practice we can see that more and more people want to become independent of glasses. »Monovision« principle (LASIK or monofocal IOL), presbyopic LASIK, contact lenses, accommodative intraocular lenses (IOL) or multifocal IOL are current attempts for presbyopia treatment.

Monovision LASIK, in which the refractive power of one eye is adjusted to improve near vision is a surgical method for presbyopia correction simultaneously with the refractive error. Generally the dominant eye is cor-

rected for distance and the nondominant eye is corrected to -0.50 D to -2.00 D. Such refraction allows good uncorrected distance, intermediate and near vision without intolerable anisometropia for most patients³. The exact amount of monovision depends on the age and desires of the patient⁴. Patient selection and patient education are critical elements in monovision success. When counseling patients preoperatively, it is important to consider occupation, sports, hobbies, and the need to maintain uncorrected near vision⁵. Most of the patients who underwent LASIK monovision are myopes who were intentionally uncorrected, but also hyperopes who were overcorrected and emmetropes whom mild myopia was induced⁶. The success or failure of monovision is largely dependent on a mechanism called intraocular blur suppression. In those individuals for whom monovision works, the brain suppresses unwanted image and a clear image dominates. The binocular visual acuity is usually slightly reduced, but this tends to improve over time in those individuals who are adapting to monovision. In patients for whom monovision does not work, the brain has difficulty suppressing the unwanted image and there is a consistent ghost image that is very disturbing and unacceptable to most. Amount of induced myopia, age, question of stereoacuity and patient selection are main controversies in principle of monovision¹.

Refractive lens exchange (RLE) with multifocal intraocular lens (MFIOL) implantation is effective intraocular, surgical method for presbyopia treatment⁷. Multifocal intraocular lenses enable good near and distant vision and a high rate of spectacle independence. Optical design of these lenses, both refractive and diffractive causes some visual disturbances such as haloes and glare. Diffractive MFIOLs enable better near vision and refractive better intermediate vision, but cause more haloes and are dependent on pupil size^{8,9}. Patients satisfaction after MFIOL implantation is very high and most of side-effects are temporary. The period of 6–12 months of neuroadaptation is needed and expectable^{10,11}. Patient selection is very important. Hyperopes with more than $+1.00$ D and myopes more than -3.00 D are candidates for MFIOL. Patients with preoperative astigmatism more than 1.00 D, with macular pathology, amblyopia, glaucoma, unrealistic expectations and high visual demands should be excluded. Postoperative astigmatism or other refractive surprises may cause patients dissatisfaction¹². This problem can be solved by LASIK procedure¹³. Combination of refractive MFIOL in the dominant eye and diffractive one in the other eye (»Mix and Match«) can give patient good visual acuity at all distances¹⁴.

Patients and methods

In this prospective, randomised, comparative study, we divided patients in two groups. Refractive lens exchange with multifocal diffractive intraocular lens implantation (Tecnis ZA9003, AMO, USA) was performed in first, »RLE Group«. Tecnis Multifocal IOLs were billa-

terally implanted to 50 patients (N=100 eyes). The surgery was performed by two experienced surgeons at two PHACO machines (»Infiniti« Alcon and »Signature« AMO, USA). In second, »Monovision Group«, LASIK Monovision was performed to 50 patients (N=100 eyes). In »RLE Group« mean age was 53 ± 2.9 years, 31 females and 19 males. Including criteria were presbyopia and hyperopia more than $+1, 00$ D, myopia more than -3.00 D, need for a bilateral IOL implantation, patients who dislike glasses and highly motivated for spectacle independence. Patients with astigmatism over $1,00$ D, amblyopia, retinal or any other serious ocular pathology, professional drivers, people with high professional visual needs or unrealistic expectations were excluded. Patients in »Monovision Group« were presbyopes; myopes (42 patients) and hyperopes (8 patients) between 42 and 51 years (mean age 47 ± 1.7), 35 females and 15 males. LASIK was performed in both eyes, dominant eye was corrected for distance vision and non dominant eye for near vision (targeted myopia was -0.50 D to -1.25 D dependent on the age and patient's profession and life style). Follow up was at least 6 months. Near, intermediate and distant uncorrected visual acuity (UCVA), spectacle dependency, subjective satisfaction and visual disturbances were measured and compared in both groups. Patients were asked to fill the questionnaire about their overall subjective satisfaction (marks from 1–10).

Since there were two investigated groups, statistical significance was determined by Student t-test at level of 0.05.

Results

In »RLE Group« patients achieved excellent distance and near uncorrected visual acuity (UCVA). Distance UCVA 0.8 (20/25) or better was achieved in 90.00 % patients and in »Monovision Group« binocular distant UCVA more than 0.8 (20/25) was achieved in all patients (Figure 1) without statistically significant differences between lenses. Near UCVA J2 or better had 94.00 % patients with MFIOL compared to 78.00% with monovision. (Figure 2). There was no statistically significant difference between groups. Patients in »Monovision

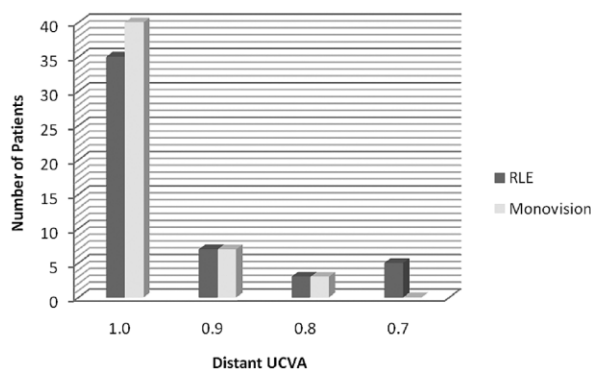


Fig. 1. Distance uncorrected visual acuity in »RLE Group« and »Monovision group« of patients. UCVA – uncorrected visual acuity, RLE – refractive lens exchange.

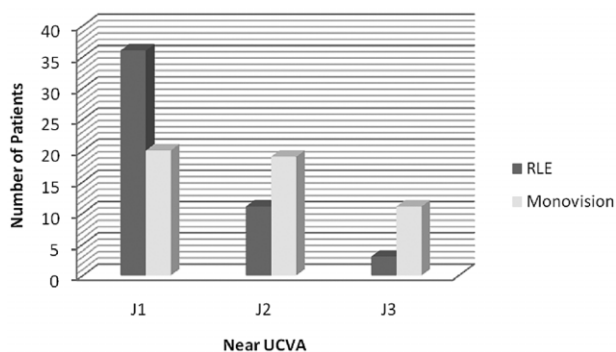


Fig. 2. Near uncorrected visual acuity in »RLE Group« and »Monovision Group« of patients. UCVA – uncorrected visual acuity, RLE – refractive lens exchange.

Group« had no complain to intermediate vision, while 18.00% of patients in »RLE Group« reported problems with work at computer. In »RLE Group«, 90.00 % of patients never wear glasses, 8.00 % wear them sometimes when they read small letters or work at computer and 2.00 % wear them for driving while in »Monovision Group«, 16.00 % of patients sometimes wear reading glasses and nobody wear distance glasses (Figure 3), also there were no statistically significant differences between groups. 94% of patients in »RLE Group« and 96% in »Monovision Group« would undergo the same procedure again. »Monovision« patients were highly satisfied, average mark was 9,2 and 8,2 in »RLE Group« (questionnaire). Patients in »Monovision Group« did not report any visual disturbances, but patients with multifocal IOL reported mild (30.00%) to severe (12.00%) problems with haloes and glare that reduces during the time.

Discussion

LASIK Monovision with residual mild myopia in non dominant eye and target emmetropia in dominant eye is an option for presbyopia treatment^{2,3}. Amount of monovision is topic of discussion. In our study and everyday practice we aim for »minimonovision«, $-0.50D$ to $-1.25D$

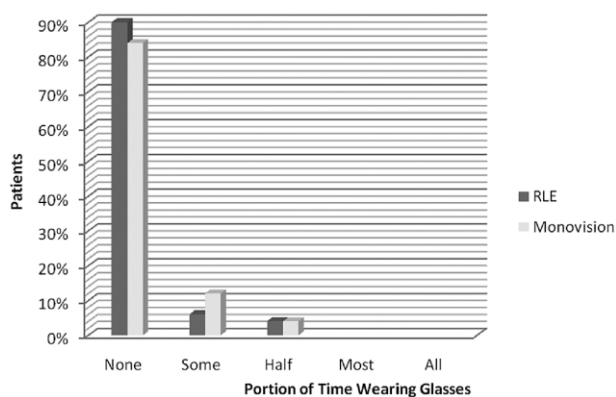


Fig. 3. Independence of glasses in »RLE Group« and »Monovision Group« of patients. RLE – refractive lens exchange.

dependent on age and patients profession and lifestyle. It gives excellent distant and intermediate vision, good near vision and reduces need for glasses⁴. Persons who are heavy readers will need reading glasses but will be able to work at computer. »Minimonovision« reduces problems with stereoacuity and doesn't affect distance vision and shortens adaptation period¹. We performed LASIK Monovision, after careful patient selection, to persons between 40 and 52, mostly myopes, but also hyperopes. Younger people who mostly work at computer are good candidates^{4,6}. For patients over 50–52 and those who do not accept monovision as an option, we performed RLE followed by MFIOL implantation. Most of the patients were hyperopes, more than $+1.00D$ but also myopes $-3.00D$ to $-6.00D$ or more, dependent on macular status. Final decision, which procedure will be done, is made after detailed explanation of all advantages, disadvantages, risks and benefits to the patient. Preoperative conversation and patient selection is the key of success in refractive surgery^{3,5}.

In our study patients in »Monovision Group« had excellent distance and intermediate vision, better than those in »RLE Group«. Postoperative astigmatism was the main reason for patient's dissatisfaction with distant vision after RLE. 12.00% of patients needed LASIK for correction of residual astigmatism. Poor intermediate vision in »RLE Group« could be improved with »Mix and Match«⁸. Near vision was much better in »RLE Group«, patients needed glasses only for very small letters, while patients with monovision had problems with longer reading. »Minimonovision«, although it is not sufficient for most near vision tasks, however satisfies most patients in age 40–50⁶. Patients with monovision reported less visual disturbances, which disappeared after adaptation period. Halo and glare after MFIOL implantation present mostly mild, but for some serious problem in night driving⁷. Period of neuroadaptation is longer, compared to monovision and may last one year¹. RLE patients were more independent on glasses than monovision ones but subjective satisfaction was higher in Monovision group. Visual disturbances and blurred distance vision are the main reasons for dissatisfaction in RLE patients and poor near vision in Monovision patients^{4,10}. It is crucial to explain to patients what can they expect after surgery and that reduces dissatisfaction³. Patients must understand that clinical outcome of RLE is permanent, unless secondary surgery is needed, but LASIK monovision is not. If we do »minimonovision«, after 50–55 years, patients will need reading glasses more often and they would need more monovision ($-2.00D$ to $-2.50D$). This anisometropia might cause loss of depth perception and subjective feeling of uncomfortable distance vision¹. That is the reason why we performed LASIK monovision to patients bellow 50–52, dependent on their wishes.

Conclusion

Refractive lens exchange with multifocal intraocular lens implantation and LASIK monovision are at the mo-

ment optimal methods for presbyopia treatment. RLE enables good near and distant vision and high spectacle independence. Visual disturbances might be serious disadvantage. LASIK monovision with residual myopia of $-0.50D$ to $-1.25D$ gives good distant and intermediate vision to persons between 40 to 50 years. Near vision can

be satisfying for some period but after 50 they will need reading glasses. The choice of refractive procedure must be personalized and preoperative counselling is key to success.

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USPOREDBA REFRAKTIVNE IZMJENE BISTRE LEĆE UZ UGRADNJU MULTIFOKALNE INTRAOKULARNE LEĆE I LASIK MONOVISIONA U TERAPIJI PRESBIOPIJE

SAŽETAK

Postoji nekoliko metoda liječenja presbiopije. Metoda izmjene bistrice leće uz ugradnju multifokalne intraokularne leće (RLE) omogućuje visoki stupanj neovisnosti o naočalama uz određene smetnje vida. LASIK monovision omogućuje pacijentu dobar vid na daljinu na dominantnom oku i dobar vid na blizinu na nedominantnom oku. U ovoj prospektivnoj randomiziranoj studiji htjeli smo usporediti kliničke rezultate kod pacijenata kojima je primjenjena jedna od navedenih metoda. U prvoj grupi (RLE grupa) imali smo 50 pacijenata (N=100 očiju) kod kojih je primjenjena metoda refraktivne izmjene bistrice leće uz ugradnju multifokalne intraokularne leće a u drugoj grupi (LASIK monovision grupa) imali smo 50 pacijenata (N=100 očiju) kojima je primjenjena metoda LASIK monovision u liječenju presbiopije. Uspredivali smo nekorogiranu vidnu oštrinu na blizinu, daljinu i srednju udaljenost; subjektivno zadovoljstvo pacijenata i vidne smetnje. Period praćenja pacijenata bio je 6 mjeseci. Pacijenti u RLE grupi imali su bolju nekorogiranu vidnu oštrinu na blizinu a pacijenti u LASIK monovision grupi imali su bolju vidnu oštrinu na daljinu i srednju udaljenost. Neki pacijenti u RLE grupi imali su vidne smetnje (»halo, glare«). Zadovoljstvo pacijenata i neovisnost o naočalama bili su visoki u obje grupe. RLE i LASIK monovision su učinkovite metode u liječenju presbiopije. LASIK monovision s ostatnom dioptrijom od -0.50 do -1.25 na nedominantnom oku kod pacijenata mlađih od 50 godina omogućuje dobar vid na svim udaljenostima bez utjecaja na stereovid. Odabir pacijenata i preoperativni razgovor s pacijentom ključni su za uspjeh liječenja.