Supplement to

CRST EUROPE

Cataract & Refractive Surgery Today

July/August 2016
Sponsored by Oculentis

Modern Presbyopia Correction

Presbyopia correction is arguably the holy grail of ophthalmic surgery. Although various concepts and products have been used over the years to treat the condition, none has prevailed as the gold standard. This is mainly because, of the available treatments, none comes without significant tradeoffs. As a result, no real solution for presbyopia correction has yet been found.

In this supplement, several surgeons present an approach to presbyopia correction that has quickly become popular: the use of lower-powered multifocal IOLs to create sufficient depth of field with minimal presence of visual disturbances.

In 2012, Oculentis created a new lens category with the introduction of the LENTIS Comfort extended depth of focus IOL. At that time, the Comfort was the only multifocal lens available with a near addition below 3.00 D. Although higher-powered lenses have always been considered the natural choice, because they provide the most natural reading distance, the higher power comes at the cost of lower quality of vision and zones of decreased visual acuity along the defocus curve. As a result, the implantation of multifocal IOLs as a means to treat presbyopia is always a compromise at best.

The impetus behind the development of the LENTIS Comfort was a strong belief in finding the perfect balance between visual performance and risk through four concepts, each of which is described below.

THE PERFECT BALANCE: FOUR CONCEPTS

Concept No. 1: Modern presbyopia correction starts with perfect distance vision. Distance vision with the LENTIS Comfort, by ISO standards, qualifies to be classified as a monofocal IOL. In this supplement, Eckhard Becker, MD, and Julia Lüblinghoff, MD, explain their clinical results comparing distance vision with monofocal IOLs and with the LENTIS Comfort.

Concept No. 2: Individual presbyopia correction caters to individual vision needs. The Düsseldorf Formula, created by Detlev R.H. Breyer, MD, allows surgeons to customize implantation of the LENTIS Comfort according to the visual needs of individual patients. This is possible due to the safety profile and excellent distance vision qualities of the IOL. Dr. Breyer and his colleagues have shown that the majority of patients, when prompted, opt for a solution with low-powered IOLs. This is because a solution with high-powered IOLs comes not only with lower quality of vision and visual acuity along the defocus curve but also with greater risk of visual disturbances including halos and glare.

It is accepted in human psychology that, when presented with a choice between different risk/benefit ratios, individuals choose the lower risk option, as they are risk-averse. Therefore, it is surprising that many patients continue to opt for a high-power/high-risk combination, which can be explained by the absence of choice or misinterpretation of the available alternatives.

Concept No. 3: Modern presbyopia correction is for the majority of patients, not for the minority. If you ask the surgeon sitting next to you if he or she uses monovision strategies to enhance the depth of field in their cataract patients, the answer will probably be yes. According to statistics, the number of monovision surgeries dwarfs that of presbyopia-correcting IOLs.

In his article, Oliver Findl, MD, describes the results of his study comparing monovision with monofocal IOLs to micro-monovision with the LENTIS Comfort. The results showed that, with the Comfort, visual quality in all categories tested was at least equal to or better than the monofocal group. The LENTIS Comfort also provided better stereo vision and better results for near vision tasks.

Concept No. 4: Modern presbyopia correction is not only for healthy eyes. In perhaps the most controversial article in this supplement, Michael J. Koss, MD, MHBA, explains his results when the LENTIS Comfort was paired against monofocal IOLs implanted in patients treated for epiretinal gliosis. Again, the LENTIS Comfort provided significant benefits over a monofocal IOL, without degrading these patients' already compromised vision.

At the end of the supplement, an audit of more than 1,000 eyes implanted with the LENTIS Comfort is provided, which depicts the special qualities of this lens and the promise that this lens category holds for the future of refractive cataract surgery. ■

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The Düsseldorf Formula: Changing the Multifocal IOL Game

A blended vision strategy using the LENTIS Comfort lens.

BY DETLEV R.H. BREYER, MD

The vast majority of patients today expect to achieve spectacle independence after cataract surgery. It may seem counterintuitive then, when nearly all patients express the desire to be free of their glasses postoperatively, that the rate of multifocal IOL implantation is so low. These lenses are known to typically provide patients with excellent far vision and good near vision.

Yet to me, the answer is somewhat obvious: Despite their ability to provide patients with adequate vision at these two distances, most multifocal IOLs have a history of producing many negative side effects, including less than desirable intermediate vision, photopic phenomena (ie, halos and glare), poor contrast sensitivity and poor near vision in mesopic lighting conditions, waxy vision, and prolonged neural adaptation. Through my own experience, which includes 10 years of scientific research with multifocal IOL surgery, I have found that, when implanting a rotationally symmetrical bi- or trifocal IOL, both unhappy patients and a bad reputation are rare but unavoidable occurrences due to the above-mentioned downsides.

In studying the rate of photopic phenomena with various multifocal IOL designs, together with our physicist, Philip Hagen, PhD, and the IVCRC.net team, we have found that a multifocal IOL with a refractive optic has a statistically and clinically overall higher tolerance for halos and glare than a multifocal IOL with a diffractive optic. Furthermore, we have shown that higher near addition and deviation from a target refraction of emmetropia cause more halos and glare to occur with rotationally symmetric diffractive multifocal IOLs. Although they can still be noticeable to patients who have an IOL with a refractive optic implanted, there is an essential subjective decrease in the presence of halos and glare after approximately 3 months postoperatively. The caveat, however, is that patients must be counseled preoperatively that there is a distinct possibility for photopic phenomena after surgery, especially with diffractive multifocal IOLs that have higher near additions for reading.

Although I rarely implant multifocal lenses with rotationally symmetrical designs, I acknowledge the need to offer patients the ability to become spectacle independent after cataract surgery and to provide them with a solution that would maximize their visual outcomes. For this reason, I developed the Düsseldorf Formula, a blended vision strategy providing patients with easy and accelerated neural adaptation and increased postoperative satisfaction.

THE BIG IDEA

The idea for the Düsseldorf Formula came to me after listening to Dan Z. Reinstein, MD, MA(Cantab), FRCSC, DABO, FRCOphth, FEBO, speak about laser blended vision at the Asia-Pacific Association of Cataract and Refractive Surgeons. In a nutshell, laser blended vision uses a mini-monovision strategy to modulate spherical aberration on the cornea and increase the depth of focus of the entire visual system by approximately 1.50 D. With this technique, patients can achieve good near vision, a lower degree of anisometropia than traditional monovision, and a blended zone of vision between eyes at intermediate vision. This strategy has worked well for presbyopia correction in my patients.

I began to think about how a similar strategy to Dr. Reinstein's could be applied to IOL implantation, giving patients with a high demand for spectacle independence and zero tolerance for dysphotopsia the opportunity to achieve the same quality and range of vision, without the unwanted side effects of photopic phenomena, decreased intermediate vision, and contrast sensitivity in mesopic conditions. In short, what I discovered was that patients could achieve a zone of blended vision when the LENTIS Comfort (Oculentis) was implanted bilaterally, whereby the target in the dominant eye was emmetropia and in the nondominant was -1.50 D. In this way, the dominant eye can provide the patient with excellent distance UCVA and very good intermediate UCVA, with minimal dysphotopsia, and the nondominant eye can provide the patient with excellent intermediate UCVA and functional near UCVA. Furthermore, the LENTIS Comfort IOL has better contrast sensitivity than any spherical IOL we routinely implant, causing less halos and glare and providing better vision for nighttime driving and reading.

FOUR WAYS TO CUSTOMIZE

I have always found it essential to understand exactly what kind of vision each patient expects to achieve after cataract surgery and then tailor IOL selection to his or her preferences. With a little more research into blended vision strategies, I devised the Düsseldorf Formula (Figure 1), in which surgery can be customized in one of four ways to ensure achievement of a patient's needs and wishes.

No. 1: Comfort Emmetropic Vision. In this strategy, the LENTIS Comfort MF15, also available as toric IOL, is implanted bilaterally with a 1.50 D addition. With a target of emmetropia, the goal of this strategy is to provide the patient with enhanced intermediate

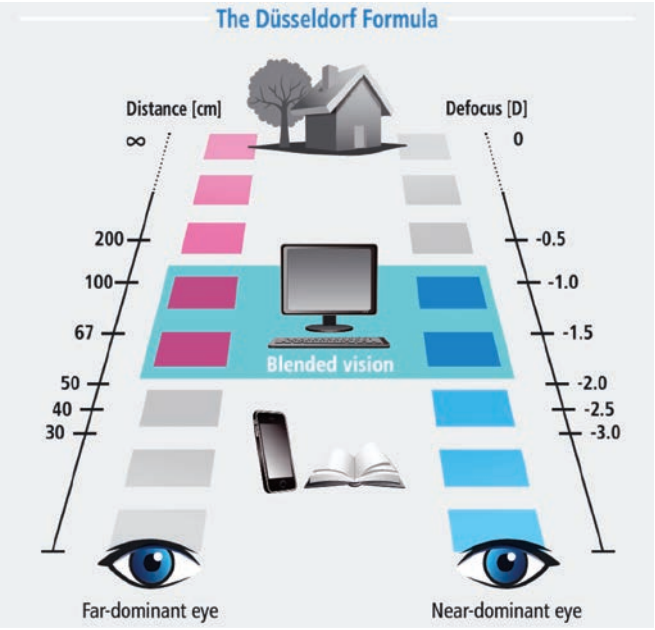

Figure 1. The Düsseldorf formula can be used to create a blended zone of vision in the intermediate range.

vision and extended depth of focus for distance and intermediate vision (Figure 2). Patients may require spectacle correction for short near vision with small letters, however. Generally speaking, distance-dominant patients respond well to Comfort Emmetropic Vision. These patients can include those who enjoy golfing, driving a motorcycle, sailing, playing tennis, riding a bike, and skiing, for instance. The advantage of this strategy is that patients can achieve perfect far and intermediate vision and adequate near vision. Newspaper reading is possible in good lighting conditions.

No. 2: Comfort Blended Vision. In this, my favorite strategy, the patient receives a LENTIS Comfort MF15 in the dominant eye, targeting emmetropia for perfect vision from distance to intermediate, and, in the nondominant, either a LENTIS Comfort MF15 with a target of -1.50 D or a LENTIS Comfort MF20, also available as toric IOL, with a target of -1.25 D for perfect vision from intermediate to near. The goal of Comfort Blended Vision is to provide general extended depth of focus with increased vision at all distances (Figure 2). The advantage of this strategy is that the patient achieves perfect stereoscopic vision at the overlap area. Two added bonuses are that patients typically have excellent contrast sensitivity and do not experience any halos and glare. Patients who do well with Comfort Blended Vision include those who enjoy activities requiring both distance and near vision and desire spectacle independence for both. One such example is a hunter. For reading small print, however, patients might need reading glasses.

Two clinical pearls should be mentioned with this strategy: (1) If the patient is intolerant to halos and glare, we prefer the LENTIS Comfort MF15 bilaterally, and, if the patient works many hours on a personal computer, we favor the LENTIS Comfort MF15 and LENTIS Comfort MF20 combination. (2) Do not forget to show the Düsseldorf Formula chart to your patients before surgery, as some

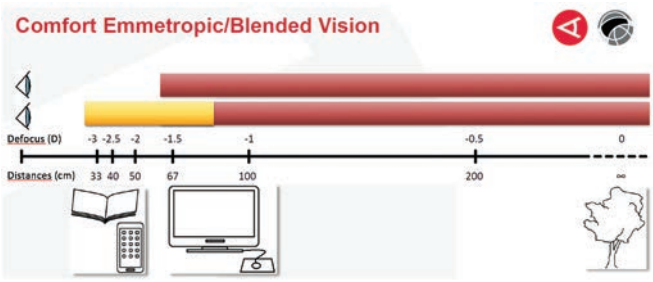

Figure 2. Comfort Emmetropic Vision (red bars) and Comfort Blended Vision (red bar above, yellow bar below).

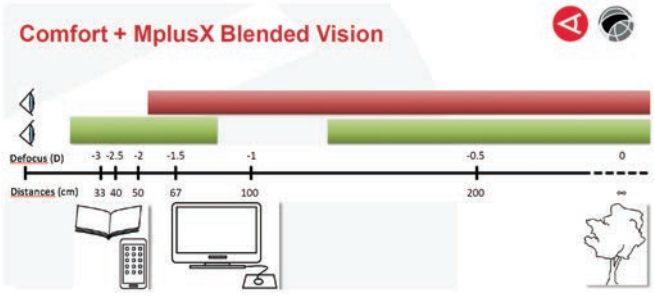

Figure 3. Comfort + MplusX Blended Vision.

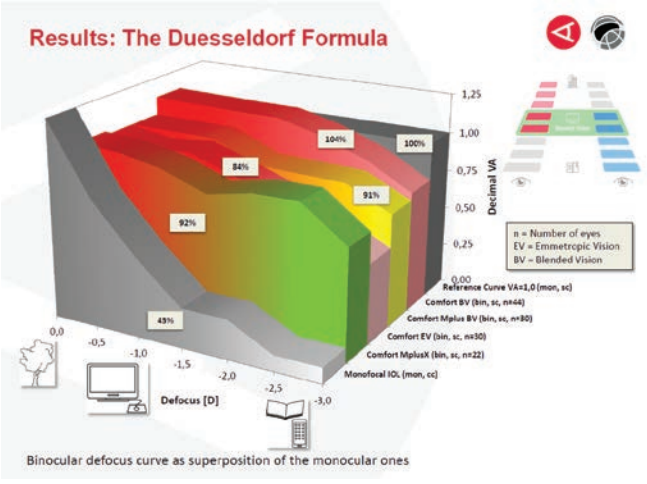

Figure 4. The binocular defocus curves of the LENTIS line of IOLs.

patients might not like the idea of "two different eyes."

No. 3: Comfort Office Vision. In this strategy, the LENTIS Comfort MF15 is implanted in both eyes, with a target of -1.50 D. Generally speaking, near-dominant patients—those who tend to spend most of their time in the office or at home and enjoy reading e-books and using their tablets or personal computer—respond well to Comfort Office Vision. If a patient prefers spectacle independence for indoor activities and does not mind wearing glasses outdoors, Comfort Office Vision is the best option. The advantage of this strategy is that patients achieve easy reading and computer use, without the need for progressive spectacles. Glasses will be required for distance vision.

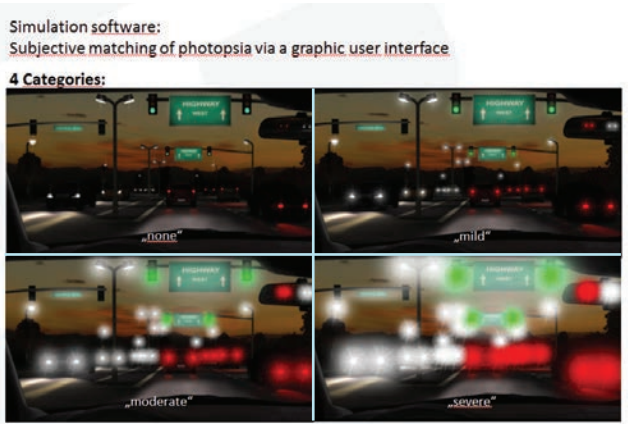

Figure 5. Patients who received Comfort Emmetropic Vision and Comfort Blended Vision subjectively matched their postoperative vision to simulations similarly to that of a control group.

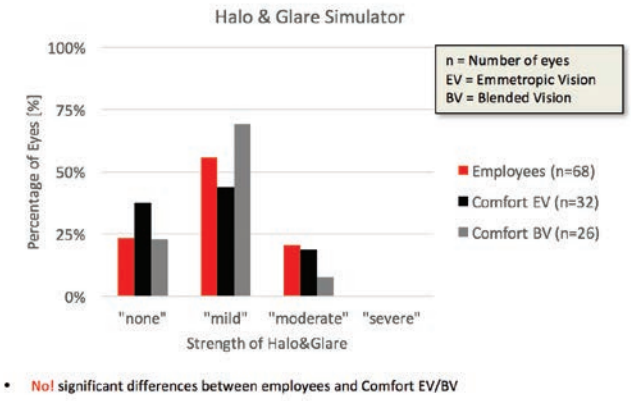

Figure 6. The strength of halos and glare perceived by patients who selected the Comfort Emmetropic Vision and Comfort Blended Vision strategies and by a control group.

No. 4: Comfort + MplusX Vision. In this strategy, the patient receives a LENTIS Comfort MF15 in the dominant eye and a LENTIS MplusX, also available as a toric IOL, in the nondominant eye. The target in both eyes is emmetropia. The goal of this strategy is to combine segmental multifocal IOLs with different additions in attempt to provide the patient with improved near vision and an enhanced overlap area for extended stereoscopic vision (Figure 3). Generally speaking, patients who have high expectations to read small and fine print and who work for many hours on their personal computers do well with this strategy. Nevertheless, you must inform patients that they will experience some halos and glare in the MPlusX eye.

STUDY RESULTS

Since incorporating the Düsseldorf Formula into practice in 2013 and presenting my preliminary results the following year in London and in Barcelona in 2015, I have had the opportunity to revisit my data and include a larger patient population. Now, my results represent implantation of the LENTIS Comfort in 786 eyes, the Mplus MF20 in 61 eyes, and the MplusX in 46 eyes. Binocular defocus curves in this population of eyes are shown in Figure 4.

Using simulation software, we asked patients who elected one of the four strategies of the Düsseldorf Formula to subjectively match their postoperative vision with no, mild, moderate, and severe photopic phenomena simulations (Figure 5). No significant difference was found in the level of photopic phenomena perceived by patients who selected the Comfort Emmetropic Vision (n=32) or Comfort Blended Vision (n=26) strategy and that of a control group (n=68), and neither group experienced any severe glare or halos (Figure 6). Patients who elected the Comfort + MplusX vision strategy and required a high addition (>3.00 D) did report a slightly stronger recognition of halos and glare as compared with the control group.

Patients were also asked to fill out a quality of vision questionnaire. In short, the questionnaire showed a high rate of patient satisfaction with the quality of near, intermediate, and distance vision; however, one patient in the Comfort Emmetropic Vision and one in the Comfort Blended vision group were not satisfied with their postoperative distance vision due to hyperopic and myopic shifts. Furthermore, with regard to intermediate vision, the values for the LENTIS MplusX were surprisingly good compared with the defocus curve, and, regarding near vision, patients who elected Comfort Blended Vision did better than those who elected Comfort + Mplus X Vision.

CONCLUSION

I am a firm believer that we should always aim to provide patients undergoing cataract surgery with a solution that meets their individual visual needs and requirements. With that in mind, I developed the Düsseldorf Formula to increase the likelihood that my patients can indeed achieve their expectations in regard to their vision, without the risk of photopic phenomena and reduced contrast sensitivity that can result in problems driving at night and reading in mesopic conditions.

Although no case is as straightforward as it initially seems, selecting the correct strategy for the patient can increase our chances of providing truly remarkable postoperative outcomes. Using the Düsseldorf Formula as a guide to implanting the LENTIS line of IOLs in a strategic fashion, according to patient requirements, allows us for the first time in the history of multifocal IOL surgery to provide our patients with spectacle independence nearly without the risk of photopic phenomena and loss of contrast sensitivity. This fact allowed us to use this strategy in close to 80% of our cataract and about 95% of our refractive lens exchange patients. Could you do this with rotationally symmetric diffractive multifocal IOL?

Coming full circle: The Düsseldorf Formula—Changing the multifocal IOL game? Definitely for us, it has! ■

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Comparison: LENTIS Comfort Versus Monovision

Although differences exist between monovision and low near-add IOLs, both strategies provide similar visual acuity and contrast sensitivity.

BY OLIVER FINDL, MD

It is no secret that the ultimate goal of modern cataract surgery is for patients to achieve spectacle independence. Throughout the years, many surgeons have relied on bilateral implantation of a monofocal IOL, aiming for emmetropia or low myopia, to reach this goal. Although this strategy can lead to a high level of patient satisfaction in distance vision, it is not uncommon for patients to require spectacle correction for reading vision and for other general near vision tasks. Some surgeons have turned to another strategy to achieve spectacle independence, and that is bilateral implantation of a multifocal IOL. But with this strategy, too, there are visual drawbacks, including problems with dysphotopsia symptoms including halos and glare.

Yet another option that can afford patients the ability to achieve spectacle independence is monovision. The advantages of this strategy include the safety of monofocal IOL technology regarding dysphotopsia and contrast sensitivity and it is cheaper than the implantation of two multifocal IOLs; however, there are still drawbacks including reduced stereopsis and the need for a longer neural adaption period than what is required of other strategies. Furthermore, the concept of having different eyes can be intimidating to some patients.

So what is the best option for patients who prefer spectacle independence, or at least less spectacle dependence, postoperatively? My colleagues and I recently compared the visual acuities, contrast sensitivities, stereo vision, and spectacle independence in a randomized, controlled trial with 35 patients implanted bilaterally with a low near-add IOL (LENTIS Comfort; Oculentis) to that of 35 patients who underwent a monovision strategy with bilateral implantation of the LENTIS L-313 monofocal IOL (Oculentis). All patients had an age-related cataract, corneal astigmatism not exceeding 1.50 D, and motivation to be less dependent on their spectacles.

In the Comfort group, a micro-monovision (0.50 D difference) strategy was employed, whereas in the monovision group, it was a mini-monovision (1.25 D difference) strategy. The target refraction in the dominant and nondominant eyes of the Comfort group was emmetropia and -0.50 D, respectively, and, in the monovision group, these targets were emmetropia to -0.25 D and -1.50 D, respectively (Figure 1).

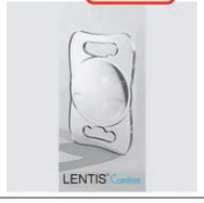
Group	Multifocal	Monovision
IOL	**LENTIS COMFORT** bilateral multifocal, near addition: +1,5 dpt 	**LENTIS L-313** bilateral monofocal 
Target refraction dominant eye	0,00 dpt	0,00 bis -0,25 dpt
Target refraction non-dominant eye	-0,50 dpt **Micro-monovision**	-1,50 dpt **Mini-monovision**

Figure 1. Description of the vision strategies used in the Comfort and monovision groups.

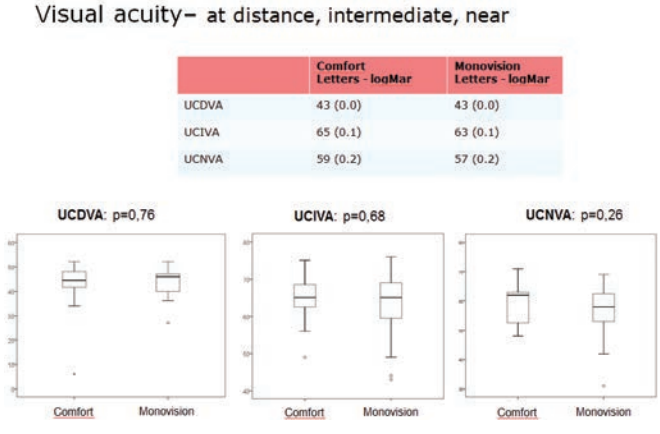


Figure 2. Visual acuity at distance, intermediate, and near.

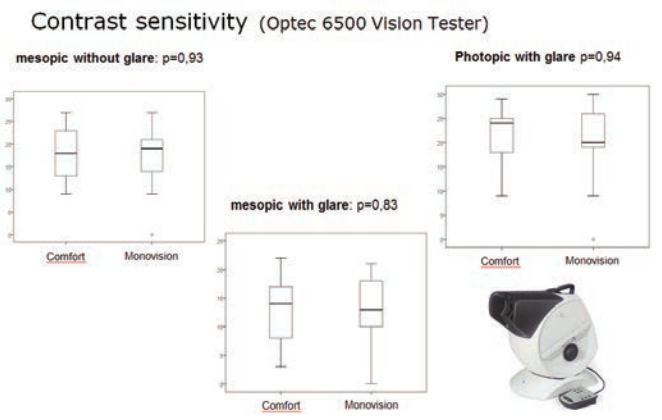


Figure 3. Contrast sensitivity in the Comfort and monovision groups.

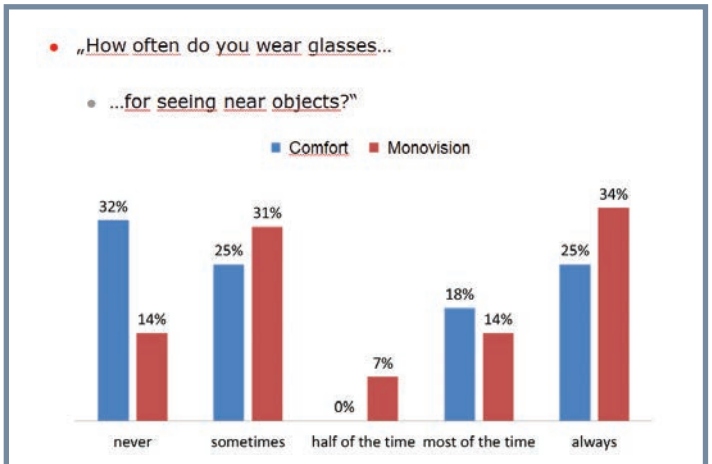


Figure 5. Patient questionnaire responses to the question: How often do you wear glasses for seeing near objects?

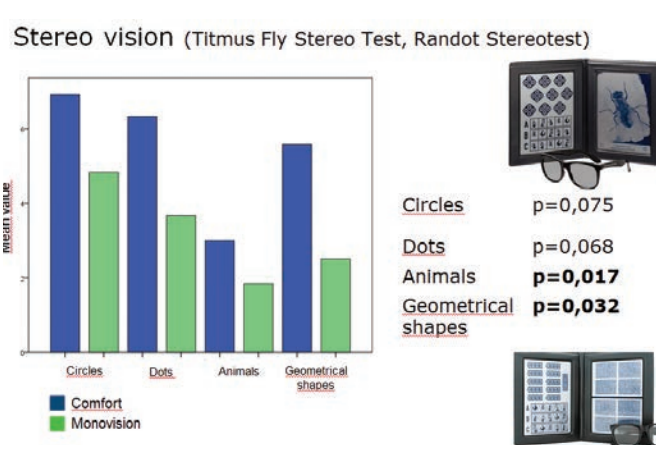


Figure 4. Stereo vision in the Comfort and monovision groups.

STUDY OUTCOMES

A total of 57 patients completed the study. The reasons for dropout included three withdrawals of consent, one lost to follow-up, and four protocol deviations. Of those included in the study, 28 patients were in the Comfort group and 29 in the monovision group. Patients ranged in age from 41 to 88 years.

Distance, intermediate, and near visual acuities for both groups at 3 months are found in Figure 2. Likewise, contrast sensitivity in both groups is found in Figure 3 and stereo vision in Figure 4. Regarding reading speed, the mean reading speed of patients in the Comfort and monovision groups was 107 ±22 and 114 ±34 words/minute, respectively. The mean reading distance in these groups was 50.3 ±13.8 and 48.9 ±11 cm, respectively.

According to the results of a patient questionnaire, there was significantly more near spectacle independence in the Comfort group than in the monovision group (32% vs 14%; Figure 5). Additionally, 92.8% of patients in the Comfort group and 100% of patients in the monovision group said that they never needed glasses for distance vision, and 70% and 77%, respectively, for seeing objects at arms' length. Dysphotopsia rates were very low for both groups, as would be expected for the low near-add IOL.

We also studied IOL decentration and tilt, which were clinically insignificant in all patients. The mean values for decentration and tilt in the Comfort group were 0.39 ±0.19 mm and 3.4°/3.5° (x,y), respectively, and, in the monovision group, they were 0.38 ±0.20 mm and 2.5°/2.4°, respectively.

CONCLUSION

The results of our study have shown that bilateral implantation of the low near-add LENTIS Comfort IOL and bilateral implantation of the LENTIS L-313 monofocal IOL produce similar results in regard to visual acuity, contrast sensitivity, and IOL tilt and decentration. The LENTIS Comfort provided patients with better stereo vision and less spectacle dependence for near vision tasks. ■

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- Financial interest: None acknowledged

LENTIS Comfort: Enhancing Visual Performance

Compared with a standard monofocal IOL, the low-add LENTIS Comfort provided patients with better visual acuity and contrast sensitivity and increased depth of focus.

BY ECKHARD BECKER, MD; AND JULIA LÜBLINGHOFF, MD

The days of implanting a standard monofocal IOL in every eye of every patient presenting for cataract surgery are no longer. Today, in addition to standard monofocal IOLs, patients have a plethora of other lenses to choose from, including multifocal, trifocal, accommodating, and low-add monofocal lens designs. In an attempt to better understand the possible differences in quality of vision and contrast sensitivity between a low-add extended depth of focus (EDOF) IOL and a standard aspheric monofocal IOL, we recently conducted a prospective, randomized, comparative, interindividual study of two IOL designs.

STUDY DESIGN

A total of 19 patients underwent bilateral implantation of either the LENTIS Comfort (Oculentis), an EDOF IOL with a 1.50 D addition, or

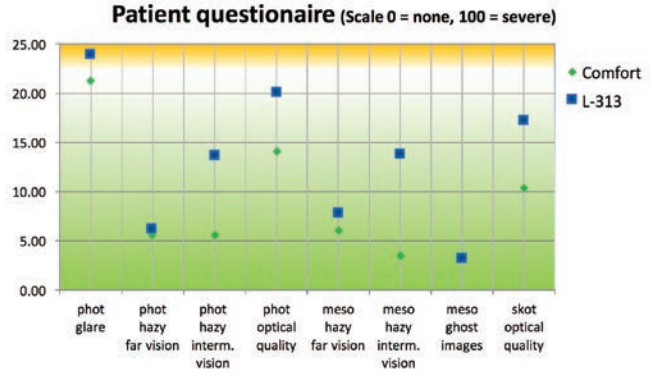

Figure 1. Results of the patient questionnaire.

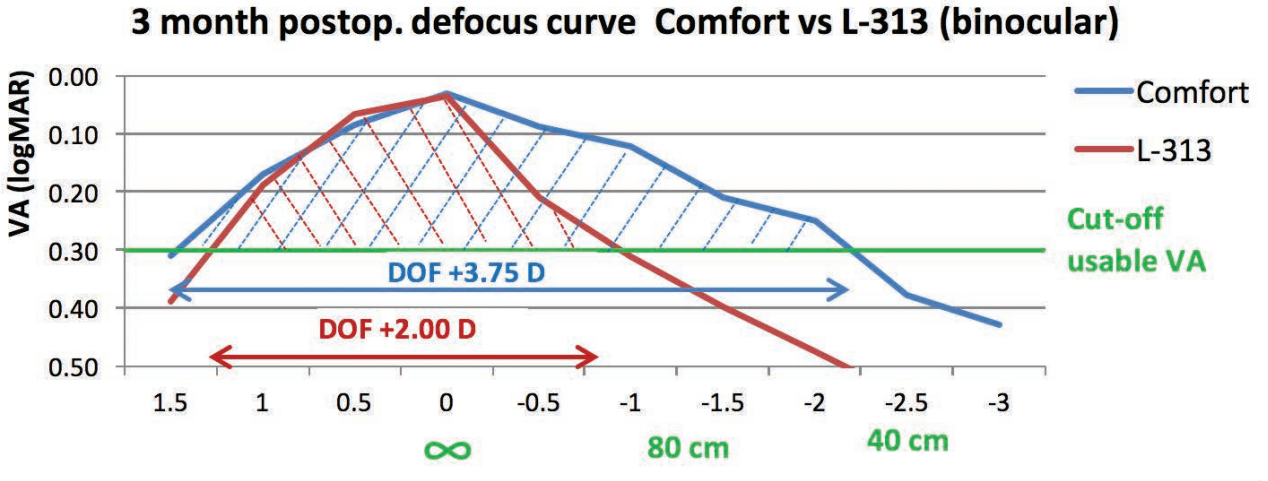

Figure 2. Increased depth of focus for the LENTIS Comfort IOL, showing usable visual acuity from far to near distance up to 45 cm and increased visual capacity.

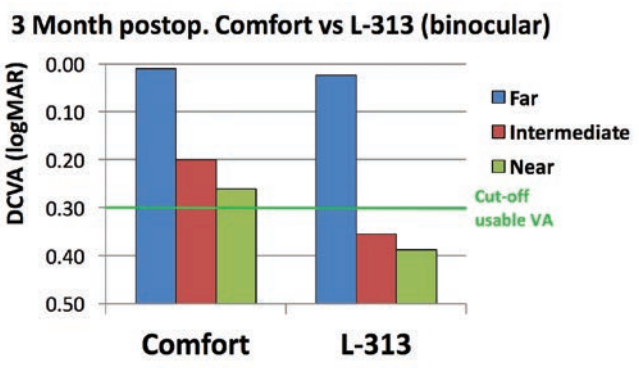

Figure 3. Distance-corrected visual acuity at 3 months postoperatively.

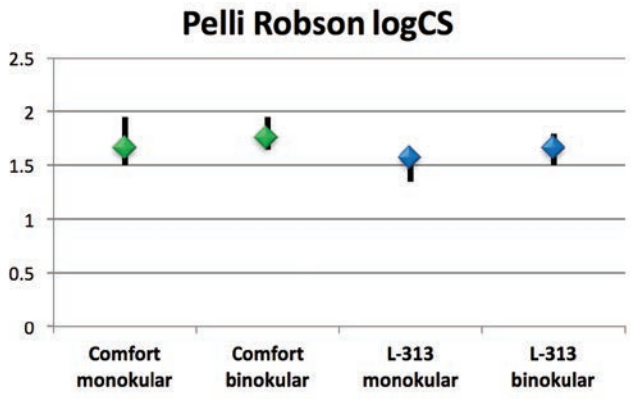

Figure 4. Contrast sensitivity was comparable between the LENTIS Comfort and the LENTIS L-313 monofocal IOL.

the LENTIS L-313 (Oculentis), a monofocal IOL. A target refraction of emmetropia was used for both IOL groups (group 1 = Comfort group; group 2 = L-313 group). The average spherical equivalent value of the implanted Comfort was 20.75 D; the median spherical equivalent value for the LENTIS L-313 IOL was 22.00 D.

Group 1 consisted of 20 eyes of 10 patients with a mean age of 69.8 years, and group 2 consisted of 18 eyes of nine patients with a mean age of 67.7 years. Follow-up in groups 1 and 2 was carried out on day 1 and at 3 months postoperatively. UDVA and CDVA at far, intermediate (80 cm), and near (40 cm) were evaluated postoperatively on day 1 and after 3 months. Furthermore, contrast sensitivity testing with the Pelli-Robson contrast sensitivity chart and patient satisfaction by means of a questionnaire (Figure 1) were conducted postoperatively. A monocular and binocular defocus curve was created at a range of 1.50 to -3.00 D for both study groups (Figure 2).

RESULTS

Day 1. Prior to surgery, distance UCVA and BCVA was 0.69 ±0.30 logMAR and 0.19 ±0.08 logMAR in group 1, respectively, and 0.54 ±0.26 logMAR and 0.23 ±0.11 logMAR in group 2, respectively. After the first postoperative day, these measurements increased to 0.17 ±0.14 logMAR and 0.07 ±0.08 logMAR, binocularly, in group 1. In group 2, these measurements, also binocularly, were 0.12 ±0.12 logMAR and 0.03 ±0.08 logMAR, respectively.

Month 3. Visual performance after 3 months indicated that binocular UCVA was 0.12 ±0.13 logMAR in group 1 and 0.09 ±0.08 logMAR in group 2. CDVA for far, intermediate, and near in group 1 was 0.01 ±0.05, 0.20 ±0.13, and 0.26 ±0.07 logMAR, respectively, and 0.02 ±0.06, 0.35 ±0.11, and 0.39 ±0.06 logMAR in group 2, respectively (Figure 3). In both groups, the binocular evaluation of contrast sensitivity showed a comparative functional outcome (group 1, logCS = 1.76; group 2, logCS = 1.67; Figure 4).

CONCLUSION

Patients can achieve comparatively good distance vision after bilateral implantation of the LENTIS Comfort IOL and the LENTIS L-313 monofocal IOL. However, as shown by our study, the LENTIS Comfort EDOF IOL with a 1.50 D add can enhance visual performance at intermediate and near distances up to 40 cm, providing patients with a greater possibility of performing everyday activities without spectacles. Likewise, the LENTIS Comfort was shown to increase depth of focus at a greater rate than a standard cataract solution with a monofocal IOL. The defocus curve in Figure 2 depicts how the LENTIS Comfort provided patients with usable visual acuity from far to near distance and increased their visual capacity. ■

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Enhancing Quality of Life in Patients With ERM

The Comfort IOL implanted during phaco-vitrectomy can provide significantly better intermediate UCVA than a monofocal IOL.

BY MICHAEL J. KOSS, MD, MHBA

Historically, a combined phaco-vitrectomy procedure whereby a monofocal lens is implanted into the capsular bag is the most common treatment for an epiretinal membrane (ERM). In recent years, however, more surgeons have both considered and tried modifying the treatment course by implanting a bi- or multifocal IOL in place of the monofocal. Until now, there has been no solid indication that such an approach would influence the visual acuity of those patients.

My colleagues and I presented a poster at the German Ocular Surgeons (DOC) meeting in Nuremberg in which we detailed the results of a prospective clinical study comparing the postoperative visual acuity in patients with ERM undergoing phaco-vitrectomy who received a LENTIS Comfort LS-313 MF15 IOL (Oculentis) to that of patients who underwent the same procedure but received a monofocal lens.

PATIENTS AND METHODS

A total of 20 patients with a mean age of 69 years underwent a standardized three-port pars plana vitrectomy with membrane peeling in conjunction with phacoemulsification and IOL implantation. Patient age, preoperative visual acuity, and average retinal thickness were similar in both groups. All 10 patients who were enrolled in group 1 received the LENTIS Comfort LS-313 MF15 (Oculentis), with 1.50 D add; all 10 patients enrolled in group 2 received the CT Asphina (Carl Zeiss Meditec), a standard monofocal IOL. Patients with macular hole or those suffering from other compromising ocular conditions were ineligible for the study.

All patients underwent thorough pre- and postoperative examination with spectral-domain OCT (SD-OCT) and the IOLMaster (Carl Zeiss Meditec). Also, at 6 to 12 months postoperatively, visual acuity at 40 cm, 80 cm, and 4 m was tested with the Early Treatment of Diabetic Retinopathy Study (ETDRS) charts and also by estimating the defocus curve from 1.50 to -3.50 D in 0.50 D steps for the operated eye (Figure 1).

Patients were also asked to answer a questionnaire in which they rated their overall visual quality; the presence of halos, starbursts, or ghosting; and blurry vision for distance and for computer work, both in bright and dim light conditions (Figure 2).

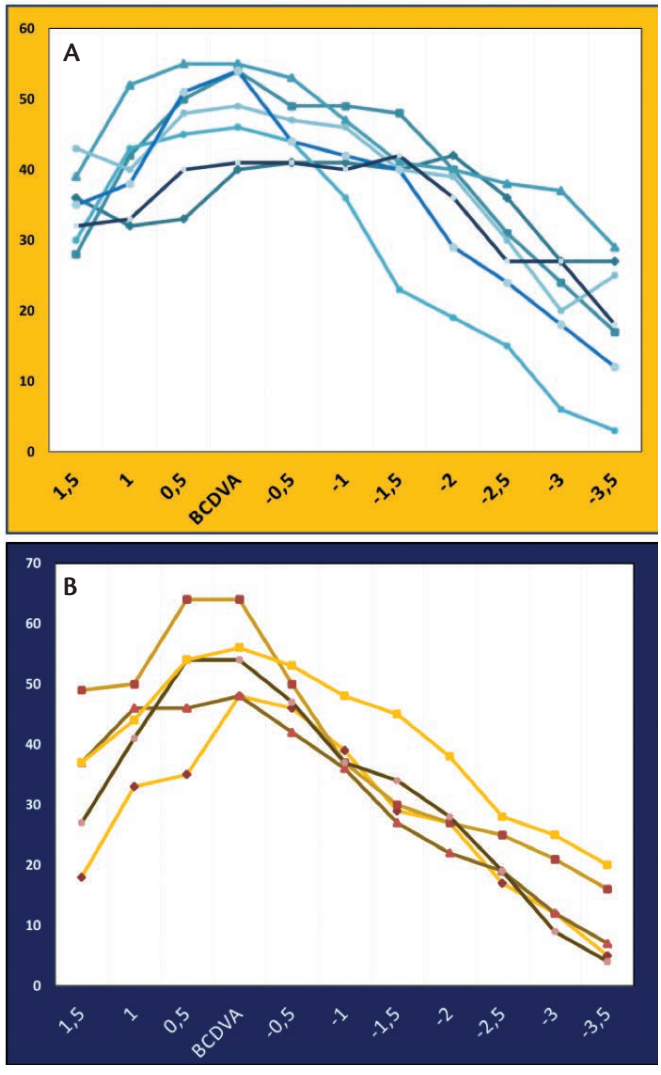

Figure 1. Examples of defocus curves in group 1 (A) and in group 2 (B).

	Oculentis® lens N=10	Monofocal lens N=10
Age (years)	69,0 ± 6,9	70,5 ± 6,3
AvT (µm) pre-op	452,78 ± 114,38	426,3 ± 104.14
AvT (µm) post-op	393,56 ± 28,06	376,50 ± 54,25
UNVA (*)	46 ± 6	43 ± 9
BCNVA (*)	58 ± 7	52 ± 7
UIVA (*)	**58 ± 7 #**	**50 ± 10 #**
BCIVA (*)	59 ± 6	63 ± 7
UDVA (*)	37 ± 13	37 ± 16
BCDVA (*)	47 ± 7	52 ± 8
BCDVA +1,5 D (*)	35 ± 5	34 ± 11
BCDVA +1,0 D (*)	41 ± 6	43 ± 6
BCDVA +0,5 D (*)	48 ± 6	51 ± 10
BCDVA -0,5 D (*)	46 ± 4	48 ± 4
BCDVA -1,0 D (*)	43 ± 4	39 ± 5
BCDVA -1,5 D (*)	39 ± 8	33 ± 7
BCDVA -2,0 D (*)	**34 ± 8 #**	**28 ± 6 #**
BCDVA -2,5 D (*)	**28 ± 8 #**	**22 ± 4 #**
BCDVA -3,0 D (*)	22 ± 10	16 ± 6
BCDVA -3,5 D (*)	18 ± 10	10 ± 7

Table 1. Comparison of groups.

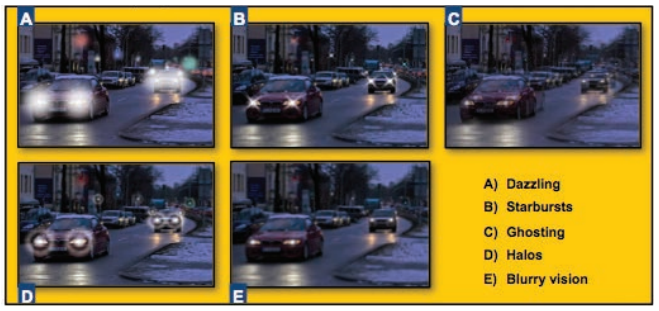

Figure 2. A portion of the patient questionnaire related to overall visual quality.

RESULTS

Just as we found preoperatively, the differences in visual acuity at 40 cm and at 4 m and the average retinal thicknesses between groups at 6 to 12 months postoperatively were not statistically significant. However, group 1 was able to read a significantly greater number of letters at 80 cm than group 2 (58 vs 50; $P<.05$), indicating that group 1 achieved better intermediate UCVA. Furthermore, patients in group 1 were able to read more letters at the -2.00 D and -2.50 D points on the defocus curve (Table 1) and reported fewer complaints of dazzling, halos, starbursts, ghosting and blurry vision than patients in group 2.

CONCLUSION

In our study, patients with ERM who received the LENTIS Comfort LS-313 MF15 faired significantly better in terms of intermediate UCVA than patients with ERM who received a monofocal IOL. Furthermore, near and distance UCVAs and distance BCVAs were similar between the groups.

Given our results, we can conclude that implanting a low-add IOL during combined phaco-vitrectomy for the treatment of ERM can be considered as an alternative to implantation of a monofocal IOL. In this population, LENTIS Comfort can increase postoperative visual acuity and, thus, quality of life. ■

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The LENTIS Comfort Toric IOL: A Means to Extend Depth of Focus

This lens provides excellent refractive predictability.

BY FLORIAN T.A. KRETZ, MD, FEBO

In recent years, we have seen increased interests in toric IOLs as well as in IOLs that can extend a patient's depth of focus and range of vision. In response to these trends, Oculentis designed the LENTIS LS-313MF15 T1-T6 (Figure 1), a toric extended depth of focus IOL indicated for the treatment of presbyopia and astigmatism.

As is seen in Table 1, the LENTIS LS-313MF T1-T6 is a one-piece toric acrylic IOL intended for capsular bag implantation. With an optic size of 6 mm and an overall length of 11 mm, the IOL can be implanted through an incision of 2 mm. It has 0° haptic angulation, and the optic and haptics are designed with 360° square edges to prevent posterior capsular opacification. The biconvex optic design of the LENTIS LS-313MF15 T1-T6 consists of aspherical and toric surfaces with an anterior sector-shaped segment with a 1.50 D addition to provide vision at intermediate distances.

CLINICAL EVALUATION

Along with my colleagues at the International Vision Correction Research Centre Network (IVCRC.net) and at the David J. Apple International Laboratory of the Department of Ophthalmology, University of Heidelberg, I recently researched use of this IOL in cataract surgery and in refractive lens exchange.

A total of 38 eyes were included in the study. All patients had preoperative astigmatism of 0.75 D or more, were presbyopic, and had a desire for spectacle and contact lens independence. The presence of manifest glaucoma, uveitis, retinal detachment, iris atrophy, corneal dystrophia or degeneration, macular degeneration, or neuroophthalmological disease and prior intraocular surgery were reasons for exclusion.

Pre- and postoperative examinations (1 day, 1 week, 1 month, and 2 to 4 months) included manifest refraction, monocular and binocular UCVA and BCVA, and rotational stability of the IOL.

The Oculentis Easy Toric Calculator (Figure 2) was used to calculate IOL power.

RESULTS

Prior to surgery, the mean cylinder, sphere, and spherical equivalent in this population were -1.36 D, -0.05 D, and -0.73 D, respectively. By 1 month postoperatively, these figures had decreased to -0.25 D, -0.06 D, and -0.19 D, respectively, indicating that the LENTIS Comfort toric IOL effectively reduced sphere and cylinder,

Figure 1. The LENTIS Comfort toric LS-313MF15 T1-T6.

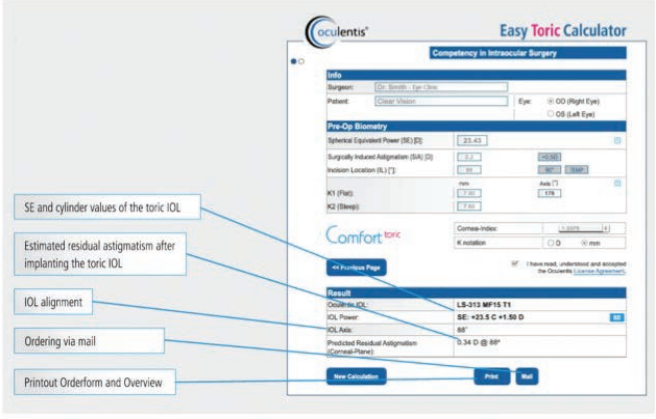
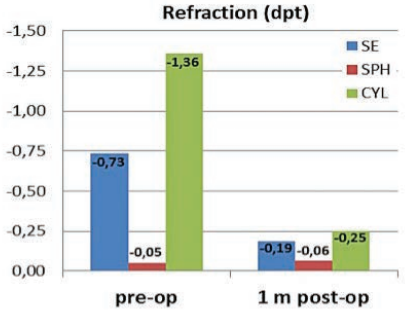


Figure 2. The Oculentis Easy Toric Calculator.



- Effective reduction of sphere and cylinder at 1 month postop.
- Small deviation from emmetropia

→ **Excellent refractive predictability**

Figure 3. Refractive stability of the LENTIS Comfort toric IOL.

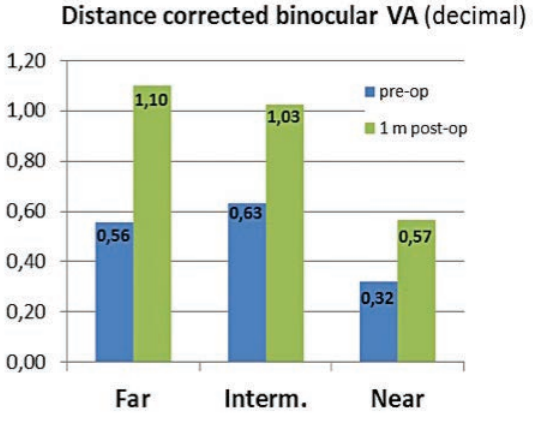


Figure 4. Binocular CDVA preoperatively and at 1 month.

IOL Rotation (n=37):

- 1 day post-op: 2.75°
- 1 month post-op: 1.60°

→ Exceptional rotation stability:

Figure 5. The study demonstrated exceptional rotational stability.

Product	LENTIS Comfort LS-313 MF15 T1-T6 (aspheric / standard)
Type	One-piece toric acrylic IOL for capsular bag fixation
Optic Size	6.0 mm
Overall Length	11.0 mm
Haptic Angulation	0°
Optic Design	Biconvex Aspherical and toric surface -posterior, sectorshaped nearvision segment - anterior: +1.5D
Design	Optic and haptics with square edges, posterior 360° continuous barrier effect
Material	HydroSmart® - a copolymer, consisting of acrylates with hydrophobic surface, UV absorbing
Available Diopters	SE: +10.0D to +30.0D (0.5D) Cyl.: T1 +1.5D | T2 +2.25D | T3 +3.0D | T4 +3.75D | T5 +4.5D | T6 +5.25D
Refractive Index	1.46
Est. A-Factor [acoustic]	118.0
Est. A-Factor [optical]	118.2 (SRK/T)
Anterior Chamber Depth	4.97 mm
Recom. Incision Size	2.4 mm

Table 1. Characteristics of the LENTIS Comfort toric IOL.

caused only a small deviation from emmetropia, and provided excellent refractive stability (Figure 3).

With regard to monocular visual acuity at 1 month postoperatively, the average distance and intermediate UCVAs were both greater than 1.0, and the average near UCVA was approximately 0.5 for newspaper reading. The excellent intermediate visual results are due to the 1.50 D addition on the IOL plane.

With regard to binocular visual acuity, at 1 month postoperatively, the average UDVA and CDVA and intermediate CDVA were all greater than 1.0 (Figure 4), and the average near CDVA was greater than 0.5 for newspaper reading.

At 1 day postoperatively, the average rotational stability of the of the LENTIS Comfort toric in 37 eyes was 2.75°, and, after 1 month postoperatively, it was 1.60°. As a result, we concluded that the rotational stability of this IOL is exceptional (Figure 5).

CONCLUSION

After studying the LENTIS Comfort toric, we have concluded that this extended depth of focus IOL should be considered as an effective treatment for presbyopia and astigmatism. It provides patients with excellent refractive predictability and distance and intermediate visual acuities of greater than 1.0, good near vision for newspaper reading, and a wide range of view. It also has exceptional rotational stability, thereby decreasing the need for postoperative adjustments. ■

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YOU SEE.

LENTIS® Comfort Experience Comfort without compromise

CLINICAL METAANALYSIS OF VISUAL RESULTS WITH LENTIS® Comfort (1.089 EYES)

Investigator	n eyes	Preoperative				Postoperative						
		UDVA Mean ± SD	CDVA Mean ± SD	UNVA Mean ± SD	CNVA Mean ± SD	Follow-up (months)	UDVA Mean ± SD	UIVA Mean ± SD	UNVA Mean ± SD	CDVA Mean ± SD	DCIVA Mean ± SD	DCNVA Mean ± SD
Bilateral emmetropic target												
Alio et al	31	0.76 ± 0.52	0.31 ± 0.29	0.77 ± 0.28	0.31 ± 0.22	3	0.26 ± 0.21		0.40 ± 0.19	0.10 ± 0.16		0.39 ± 0.14
Alio et al	22	0.61 ± 0.28	0.27 ± 0.24	0.76 ± 0.27	0.36 ± 0.26	6	0.20 ± 0.14	0.19 ± 0.11	0.45 ± 0.19	0.06 ± 0.08		0.47 ± 0.13
Pietrini	50					6	0.07	0.19	0.32			
Ameline-C	75		0.45 ± 0.38		0.30 ± 0.26	> 1	0.10 ± 0.11		0.35 ± 0.25	0.02 ± 0.05		
Ramji et al	42						0.07 ± 0.09					
Reiter et al	40	0.66	0.38			3	0.2	0.26	0.37	0.08	0.28	0.49
Cech et al	61	0.42					0.04	0.22				
Morris	108	0.63 ± 0.47	0.03 ± 0.15			> 2	0.06 ± 0.17			-0.02 ± 0.07		
Kretz	60	0.46 ± 0.29	0.29 ± 0.14			3	0.00 ± 0.09	0.01 ± 0.09	0.36 ± 0.14	-0.08 ± 0.09	-0.02 ± 0.11	0.32 ± 0.23
Holland	66	0.49 ± 0.32	0.23 ± 0.23	0.68 ± 0.30		3	0.03 ± 0.12	0.17 ± 0.21	0.31 ± 0.19	-0.04 ± 0.08		
Mayer	36	0.68 ± 0.42	0.30 ± 0.19	0.84 ± 0.35	0.67 ± 0.26	3	0.07 ± 0.09	0.21 ± 0.15	0.64 ± 0.22	0.04 ± 0.09	0.18 ± 0.15	0.35 ± 0.23
Breyer et al	128	0.37 ± 0.25	0.10 ± 0.10			> 1	0.05 ± 0.09	0.10 ± 0.15	0.31 ± 0.15	0.00 ± 0.11		
Becker et al	20	0.69 ± 0.30	0.19 ± 0.08			3	0.12 ± 0.13			0.01 ± 0.05	0.20 ± 0.13	0.26 ± 0.07
Ø	**739**	**0.57**	**0.25**	**0.75**	**0.39**		**0.08**	**0.17**	**0.37**	**0.00**	**0.13**	**0.38**
Mplus or Comfort Blended Vision												
McAlinden	22						0.04 ± 0.25	0.23 ± 0.33	0.28 ± 0.27	-0.08 ± 0.07	0.23 ± 0.32	0.28 ± 0.26
Hammer	18	0.45 ± 0.36	0.31 ± 0.18			6	0.08 ± 0.17	0.05 ± 0.11	0.15 ± 0.13	-0.03 ± 0.07	0.04 ± 0.14	0.25 ± 0.15
Nijs	160					1	0.00	0.02	0.05			
Breyer et al	94					> 1	0.06 ± 0.12	0.07 ± 0.17	0.17 ± 0.11	-0.04 ± 0.07		
Findl et al.	56		0.39 ± 0.19			3	0.04 ± 0.15	0.18 ± 0.15	0.31 ± 0.19	-0.07 ± 0.10		
Ø	**350**	**0.45**	**.37**				**0.03**	**0.07**	**0.14**	**-0.06**	**0.14**	**0.27**

Ø *(average is percentage case size considered)*

Courtesy of Oculentis GmbH