Journal of Optometry (2012) 5, 9–23

Journal of Optometry

www.journalofoptometry.org

ORIGINAL ARTICLE

3-Month experience in presbyopic correction with bi-aspheric multifocal central presbyLASIK treatments for hyperopia and myopia with or without astigmatism

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Received 12 September 2011; accepted 10 December 2011
Available online 22 February 2012

KEYWORDS
Simultaneous viewing;
Distance and near vision;
Aspherical;
Multifocal;
PresbyLASIK;
Presbyopia;
Addition;
LogRAD

Abstract
Purpose: To analyze simultaneous vision (distance and near) 3-month after bi-aspheric multifocal central presbyLASIK treatments for hyperopia and myopia with or without astigmatism.
Methods: Retrospective study analyzing patients that had been treated for correcting distance ametropiae and alleviating presbyopic symptoms simultaneously. All patients had been treated in Presby Aspheric mode using FemtoLASIK. No eye had previous corneal refractive surgery. Preoperative corneal curvature ranged between 40 D and 48 D, with pachymetry thicker than 500 μm. Preoperative best distance corrected visual acuity (CDVA) was 0.1 LogMAR or better, with best corrected near vision (CNVA) of 0.2 LogRAD or better.
Results: 66 patients treated using PresbyMAX software (SCHWIND eye-tech-solutions GmbH and Co. KG, Kleinostheim, Germany) were reviewed. For 24 patients, 3-month follow-up was completed. At 3 months, 71% of patients achieved UDVA 0.1 LogMAR or better, 79% patients obtained UNVA 0.1 LogRAD or better, and 83% of eyes were within 0.75 diopters (D) of defocus. Postoperative mean spherical equivalent refraction was -0.15 ± 0.50 D. Stability was achieved from the 6-week follow-up. 92% of patients achieved UDVA 0.2 LogMAR or better and UNVA 0.2 LogRAD or better. No statistical differences between myopes/hyperopes or between males/females were found.
Conclusions: Patient selection and expectation management are essential to achieve patient satisfaction. Even though optically the results are quite predictable, some patients find it difficult to adapt to the compromise between far and near vision, and others are dissatisfied by the minor loss of distance VA.

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1888-4296/$ - see front matter
doi:10.1016/j.optom.2011.12.001

PALABRAS CLAVE
Visión simultánea;
Visión lejana y cercana;
Asférico;
Multifocal;
Presbylasik;
Presbicia;
adición;
LogRAD

Experiencia de 3 meses tras la corrección de la presbicia con tratamientos presbyLASIK centrales multifocales biasféricos para la hipermetropía y la miopía con o sin astigmatismo

Resumen
Objetivo: analizar la visión simultánea (de lejos y de cerca) 3 meses después de tratamientos presbyLASIK centrales multifocales biasféricos para la hipermetropía y la miopía con o sin astigmatismo.
Métodos: Estudio retrospectivo que incluye pacientes que habían sido tratados para corregir ametropías de lejos y a la vez aliviar los síntomas de la presbicia. Todos los pacientes habían sido tratados en modo *Presby Aspheric* utilizando FemtoLASIK. Ningún ojo se había sometido a cirugía refractiva corneal anteriormente. La curvatura corneal preoperatoria se encontraba entre 40 D y 48 D, con una paquimetría mayor de 500 μm. La agudeza visual de lejos mejor corregida preoperatoria (AVLC) era de 0,1 logMAR o mejor, con una visión de cerca mejor corregida (AVCC) de 0,2 logRAD o mejor.
Resultados: se revisaron 66 pacientes tratados con el software PresbyMAX (SCHWIND eye-tech-solutions GmbH and Co. KG, Kleinostheim, Germany). Se completó el seguimiento de 3 meses para 24 pacientes. Al cabo de 3 meses, el 71% de los pacientes había alcanzado una agudeza visual de lejos sin corregir (UDVA) de 0,1 logMAR o mejor, el 79% una agudeza visual de cerca sin corregir (UNVA) de 0,1 logRAD o mejor y el 83% de los ojos tenían hasta 0,75 dioptrías (D) de desenfoque. El equivalente esférico medio postoperatorio fue de -0,15 ± 0,50 D. A partir del seguimiento de 6 semanas se alcanzó la estabilidad. El 92% de los pacientes alcanzó una UDVA de 0,2 logMAR o mejor y una UNVA de 0,2 logRAD o mejor. No se detectaron diferencias estadísticas entre miopes e hipermétropes ni entre hombres y mujeres.
Conclusiones: la selección de pacientes y la gestión de las expectativas son clave para lograr la satisfacción del paciente. Aunque desde el punto de vista óptico los resultados son bastante predecibles, algunos pacientes tienen dificultades para tolerar el compromiso entre visión de lejos y de cerca y otros están descontentos por la mínima pérdida de AV de lejos.

Refractive corrections for presbyopia by means of excimer laser systems are as old as laser refractive surgery itself.[1] Moreira et al. stated in 1993[1]: ''After multifocal ablations, a greater spread of surface powers is observed, often with a bimodal distribution, indicative of an apparent multifocal effect. These observations suggest that in some patients undergoing photorefractive keratectomy for myopia, it may be possible to reduce symptoms of presbyopia''.

Vinciguerra et al.[2] proposed a 10–17 μm deep semilunar-shaped zone immediately below the pupillary centre, steepening the corneal curvature in that area and reported promising results with this technique.[3]

Monovision is another extended technique[4] usually in the form of dominant eye corrected for distance opposed to crossed monovision[5] (dominant eye corrected for near) offering better near vision than control patients, with minimal compromise in stereo acuity and overall high patient satisfaction.

Attempts for pseudo-accommodative cornea opened new concepts for correction of presbyopia; basically in the form of a peripheral near zone (concentric ring for near vision)[6] or in the form of a central near zone (central disc for near vision).[7]

Charman[8] concluded that the main requirement in presbyopia is extended binocular depth-of-focus to yield adequate distance and near vision with good retinal contrast at lower spatial frequencies, rather than the highest levels of acuity and modulation transfer function at a single distance. He further suggested that, for many presbyopes, this can be achieved by aiming residual high-order aberrations.

Artola et al.[9] found evidence for delayed presbyopia after photorefractive keratectomy for myopia due to the corneal aberrations induced, which may reduce the quality of the retinal image for distance but enhance near acuity by way of a multifocal effect that can delay the onset of age-related near vision symptoms.

Dai[10] was one of the first to propose the use of rigorous methodologies to theoretically optimize vision over the entire target range from near to distance.

Ortiz et al.[11] characterized the optical quality by the Strehl ratio, the spot size on the retina, and objective decimal visual acuity calculated based on measured corneal topography using Fresnel propagation algorithm based on a realistic eye model. They found that with a complete characterization of the eye and a complete propagation algorithm (that takes into account all refractive surfaces in the eye at the same time), it is possible to evaluate the optical quality in eyes of patients who have undergone central presbyLASIK treatment.

Reinstein et al.[12] successfully combined extended depth of focus with monovision in a micro-monovision protocol, whereas Epstein and Gurgos[13] combined monocular