



ORIGINAL ARTICLE

Six-month clinical outcomes after hyperopic correction with the SCHWIND AMARIS Total-Tech laser

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Hyperopia;
Refractive surgery;
Excimer laser;
Wavefront aberration;
Aspheric ablation

Abstract

Purpose: To evaluate postoperative clinical outcomes, and corneal High Order Aberrations, among eyes with hyperopia up to +5 D of spherical equivalent, that have undergone LASIK treatments using the SCHWIND AMARIS laser system.

Methods: At six-month follow-up, 100 eyes with preoperative hyperopia or hyperopic astigmatism up to +5 D of spherical equivalent were retrospectively analysed. Standard examinations, pre- and postoperative wavefront analysis with a corneal-wavefront-analyzer (OPTIKON Scout) were performed. Aberration-Free aspheric treatments were planned with Custom Ablation Manager software and ablations performed using the SCHWIND AMARIS flying-spot excimer laser system (both SCHWIND eye-tech-solutions). LASIK flaps were created using a LDV femtosecond laser (Ziemer Group) in all cases. Clinical outcomes were evaluated in terms of predictability, refractive outcome, safety, and wavefront aberration.

Results: At six month, 90% of eyes achieved $\geq 20/25$ UCVA and 44% achieved $\geq 20/16$ UCVA. Seventy-four percent of eyes were within ± 0.25 D of spherical equivalent and 89% within ± 0.50 D, with 94% within 0.50D of astigmatism. Mean spherical equivalent was -0.12 ± 0.51 D and 0.50 ± 0.51 D for the astigmatism. Fifty-two percent of eyes improved BSCVA vs. only 19% losing lines of BSCVA. Predictability slope for refraction was 1.03 and intercept +0.01 D. On average, negative corneal spherical aberrations were significantly increased by the treatments, no other aberration terms changed from pre- to postoperative values.

Conclusions: LASIK for hyperopia and hyperopic astigmatism with SCHWIND AMARIS yields very satisfactory visual outcomes. Preoperative refractions were postoperatively reduced to subclinical values with no clinically relevant induction of corneal HOA.

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PALABRAS CLAVE

Hipermetropía;
Cirugía refractiva;
Láser excimer;
Aberración de frente
de onda;
Ablación esférica

Resultados clínicos a los seis meses de una corrección de hipermetropía con el láser SCHWIND AMARIS Total-Tech

Resumen

Objetivo: Evaluar los resultados clínicos posoperatorios, aberraciones corneales de orden superior, entre ojos con una hipermetropía de hasta 5 dioptrías de equivalente esférico, previamente sometidos a tratamientos LASIK con el sistema de láser SCHWIND AMARIS.

Métodos: Tras 6 meses de seguimiento, se analizaron de manera retrospectiva 100 ojos con hipermetropía o astigmatismo hipermetrópico preoperatorio de hasta 5 dioptrías de equivalente esférico. Se llevaron a cabo exploraciones estándar, análisis de frente de onda preoperatorio y posoperatorio con un analizador de frente de onda corneal (OPTIKON Scout). Se diseñaron tratamientos esféricos sin aberraciones con el software Custom Ablation Manager y se realizaron ablaciones utilizando el sistema de láser excímero de punto flotante SCHWIND AMARIS (ambas tecnologías son de SCHWIND Eye-tech Solutions). En todos los casos, los colgajos de LASIK se crearon utilizando un láser de femtosegundo LDV (Ziemer Group). Los resultados clínicos se evaluaron a nivel de previsibilidad, resultado de refracción, seguridad y aberración de frente de onda.

Resultados: Al cabo de 6 meses, el 90% de los ojos alcanzaron agudeza visual sin corrección (AVSC) > 20/25 AVSC (UCVA) y el 44% alcanzaron > 20/16 AVSC. El 74% de los ojos se encontraban en +0,25 dioptrías de equivalente esférico y el 89% en $\pm 0,50$ dioptrías, con el 94% en 0,50 dioptrías de astigmatismo. La media del equivalente esférico fue de $-0,12 \pm 0,51$ dioptrías y de $0,50 \pm 0,51$ dioptrías para astigmatismo. El 52% de los ojos vieron mejorada la mejor agudeza visual con gafa (MAVCG) (BSCVA) frente a solamente un 19% que perdieron líneas de MAVCG. La pendiente de previsibilidad de refracción fue de 1,03 y la ordenada en el origen, de +0,01 dioptrías. Como promedio, la aberración esférica negativa de la córnea fue significativamente incrementada por los tratamientos y ningún otro término de aberración cambió entre los valores preoperatorios y posoperatorios.

Conclusiones: Utilizar LASIK para la hipermetropía y el astigmatismo hipermetrópico con SCHWIND AMARIS produce unos resultados visuales muy satisfactorios. Las refracciones previas a la operación se vieron reducidas a valores subclínicos después de la operación, sin inducción clínicamente relevante de aberraciones de orden superior de la córnea.

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The introduction of the excimer laser for refractive surgery has opened up the possibility to change the corneal curvature to compensate for refractive errors of the eye. In the case of small spot hyperopic laser in situ keratomileusis (H-LASIK), excimer laser systems produce a steepness of the cornea by ablating mainly at the periphery of the cornea.

H-LASIK treatments induce aberrations.¹ Studies^{2,3} attempted to determine the changes in corneal asphericity after H-LASIK, and found a extreme corneal prolateness, indicating large amounts of induced negative spherical aberrations. This is predominantly caused by the loss of efficiency⁴⁻⁷ at the periphery and the biomechanics of the cornea, and has been described previously by other authors.^{8,9}

The pitfalls of H-LASIK are historically important and should be mentioned, as the main problems in decentrations, decreases in best corrected visual acuity, very high frequency of retreatments, frequent residual refractive error, induction of astigmatism and induction of high levels of corneal aberrations, specifically, and spherical aberration.

Later studies on hyperopic treatments with excimer lasers also suggested an increase in negative spherical aberration.^{10,11}

By comparison of the intended and achieved topographical changes after H-LASIK surgery, de Ortueta et al.¹² obtained information as to whether the corneal power was changed as calculated, thus providing help in optimizing the ablation profiles (either in terms of nomogram adjustments or more sophisticated optimization algorithms like multifocal algorithms). Additionally, actual under- or overcorrection can be differentiated from under- or overcorrection due to wrong intended correction in this way.

A study by O'Brart et al.¹³ analyzing hyperopic LASEK using a Munnerlyn based classical profile and a 7 mm optical zone with a total treated zone of 9 mm demonstrated that the induced aberrations were lower than with the Munnerlyn profile in LASIK. A recent study by de Ortueta et al.,¹⁴ using aspheric aberration neutral profiles showed that induced aberrations are less than in previous publications. This study was undertaken to evaluate postoperative clinical outcomes and High Order Aberrations (HOA), among eyes with hyperopia up to +5 D of spherical equivalent, that underwent LASIK treatments using the SCHWIND AMARIS laser system.¹⁵

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