Diego de Ortueta

Range of hyperopia treatable with LASIK increasing

Roibeard O'hEineachain in Rome

CURRENT LASIK technology enables surgeons to correct higher degrees of hyperopia than was possible with the technique a few years ago, but the biomechanical properties of the cornea may hinder extending the limit of hyperopic LASIK much further, according to Diego de Ortueta MD, Recklinghausen, Germany.

Speaking at the 13th Winter Meeting of the ESCRS, Dr de Ortueta noted that in the early days of hyperopic LASIK, regression was a major problem because of the small optical zones then in use. However, in a report by the AAO (Varley et al, Ophthalmology 2004; 11:1604-1617), the authors concluded that a reduction in the incidence and degrees of regression after hyperopic LASIK has coincided with the use of larger optical zones and smoother transition zones.

Nonetheless, the authors of the report also concluded that LASIK was less stable and less predictable after corrections of more than +4.0 D of hyperopia.

More recent years have seen the publication of studies showing that acceptable results, in terms of predictability, best-corrected vision and refractive stability, can be achieved with LASIK in eyes with up to +6.0 D of hyperopia, Dr de Ortueta noted.

As an example, he cited the results of a multicentre US FDA study involving 293 hyperopic eyes with up to +6.0 D of sphere and up to -3.0 D of cylinder with the Nidek EC-5000 laser (Waring et al, J Refract Surg. 2008; 24:123-136).

At six months' follow-up, 63.1 per cent of eyes were within 0.5 D of emmetropia and 90.3 per cent were within 1.0 D. Furthermore, fewer than two per cent of eyes lost two lines of best spectacle-corrected distance visual acuity. In addition, the mean MRSE changed by only 0.054 D and the mean hyperopic shift was less than 0.03 D.

Similar results were reported in another study (Kezirian et al, JCRS 2008; 24:431 -438). The study involved 127 hyperopic eyes that underwent treatment up to 6 D with the Allegretto Wave laser (Wavelight).

After a follow-up of 3.2 to 4.9 years, the MRSE was within 1.0 D of its six months postoperative value in 94 per cent of eyes. Regression of effect greater than 1.0 D occurred in 4.7 per cent of eyes and progression of effect occurred in 1.6 per cent.

In another study, involving 41 patients who underwent LASIK treatment for up to +5.25 D of hyperopia with the VISX Star laser (AMO), refraction at five years' follow-up was within half a dioptre of emmetropia in 42 per cent and within one dioptre of emmetropia in 70 per cent (Desai et al JCRS 2008; 34:232-237).

He added that in his own study, involving 66 eyes undergoing LASIK for up to +5.25 D of hyperopia with the Schwind Esiris laser, 92 per cent were within 1.0 D and all were within one dioptre of intended refraction at three months' follow-up and no eyes lost any lines of BCVA (de Ortueta et al, JRS 2008;137-144). In this work the authors also explain how to predict the postoperative keratometry reading. The limit of the K reading should not be higher than 48 or 49 dioptres. So it is not the same to treat 5 dioptres of hyperopia in an eye with a preoperative K reading of 42 or with 45 dioptres.

Dr de Ortueta suggested that hyperopic LASIK treatments are unlikely to exceed +6.5 D because of the effects of corneal biomechanics. The cornea could become unstable if the mid periphery of cornea is thinner than the centre postoperatively. In the typical hyperopic eye, such an inversion of pachymetry progression would occur after a LASIK treatment for around +6.5 D, he said. We have also analysed the created corneal aberrations after hyperopic LASIK (de Ortueta et al JRS 2009 25:: 339-349) using an aspherical prile with an aberration neutral profile which induce very low aberrations.

	Platform	Range	N (eyes)	Period	Predictability	Safety loss ≥ 2 lines
Desai R et al. J Cataract Refract Surg 2008; 34:232-7	VISX Star S2	+5.25 D	41	5 y	42%± 0.5D 70%± 1.0D	2%
Spadea L et al. J Cataract Refract Surg 2006; 22: 131-7	MEL 70	+5.75 D	100	2 y	70%± 0.5D 92%± 1.0D	0
Kanellopoulos AJ et al. J Refract Surg 2006; 22: 43-47	Alegretto Wave	+ 6D	120	1 y	± 0.5D 1-3D 92% 3.25-5D 79% >5.25D 71%	0
Waring G et al J Refract Surg 2008; 24: 123-36	NIDEK EC 5000	+ 6 D	293	6 m	63%± 0.5D 90%± 1.0D	2%
De Ortueta D et al. J Refract Surg 2008; 137-144	ESIRIS Schwind	+ 5.25D	66	3 m	92%± 0.5D 100%± 1.0D	0

Courtesy of Diego de Ortueta MD

> "The goal of treatment should be to increase the curvature of the cornea without inducing aberrations and this change should be stable over time"

Pearls of hyperopic LASIK

Success with hyperopic LASIK requires consideration of numerous factors that present less of a problem in myopic eyes, Dr de Ortueta noted. They include the refraction and biometry of the eye, the creation of the flap, and the ablation algorithm, he said.

"The goal of treatment should be to increase the curvature of the cornea without inducing aberrations and this change should be stable over time," he added.

Refraction should be carried out under both undilated and cycloplegic conditions in order to uncover any latent hyperopia, which should also be corrected in the LASIK ablation, he said. It is sometimes helpful to first prescribe glasses with a dioptric power of at least 0.75 D to reduce the latent hyperopia, he added.

He noted that hyperopic eyes make flap creation more difficult because of their smaller white-to-white measurements and lower K readings. However, the flap should be large enough to expose an adequate area of the stromal bed for the total ablation. He added that he uses a superior or temporal hinge.

Dr de Ortueta recommended using an optical zone of 6.5mm so that it will cover the mesopic pupil. Centration of the ablation is controversial because hyperopic eyes have an unusually large angle Kappa, he noted. He said that he prefers to centre ablations on the vertex normal of the cornea because, unlike the pupil centre, its position does not shift when the pupil dilates and contracts.

The ablation profile is also more problematic in hyperopic eyes because it requires two transition zones, one from the centre to the mid periphery and one from the mid periphery to the periphery. The treatment of hyperopic astigmatism requires yet another transition zone

To provide good quality of vision and predictable results, the ablation profile should be aspheric and the calculation should take into account the laser's loss of efficacy in the treatments periphery because of the more oblique incidence of its beam in those areas, he added. If we looked to all pre-reviewed articles the aberration free profile centring on the Vertex of the cornea from Schwind has the lowest induced amount of aberrations in hyperopic LASIK.

"The latest results suggest LASIK can be used to treat up to +6.0 D of hyperopia with good predictability and with at most two per cent losing lines of BCVA. The induction of aberrations is also decreasing. I currently treat up to +6.5 D and I centre my ablations on the corneal vertex," he added.

ortueta@gmx.de