Less induced spherical aberration with wavefront-optimised treatments

Dermot McGrath in Paris

TOPOGRAPHY-guided treatment using the Allegretto Wave System (Wavelight Technologie) appears to be very safe and effective for enhancement in eyes with decentred ablations, small optical zones or irregular corneal astigmatism, according to Jérôme C Vryghem MD, Brussels, Belgium.

Speaking here at the XXII Congress of the ESCRS, Dr Vryghem said that his own clinical experience with the Allegretto Wave and the T-CAT software suggested that it was a particularly viable option for retreating patients who were dissatisfied with the outcome of previous refractive surgery.

"In over 80% of cases, the topography-guided treatment with the Wave system resulted in an objective and subjective improvement of the visual functions of the treated eyes. Many of these patients thought that there was no solution possible for the visual symptoms they were experiencing and it was gratifying to be able to put a smile back on their faces after treatment with the Allegretto," he said.

Dr Vryghem said that topography-guided treatment was an option for patients with highly aberrated eyes where it was difficult to obtain reproducible images with wavefront analysis or where the wavefront images were of insufficient quality.

Two-stage treatments often necessary

He also stressed the importance of careful patient selection before deciding to proceed with such treatments.

"It is vital to talk to the patient beforehand and explain that there may be a need for further treatment if we don't get the desired refractive result first time. They have to be aware that topography guided treatments are often two-stage treatments because in the first stage we want to smooth the surface, recentre the ablation and enlarge the optical zone. However, because we are not taking account of the axial length of the eye and are essentially undoing the problems caused by the initial treatments, the patients sometimes end up with a refractive surprise which then has to be retreated in the second phase," he said.

Stephen F. Brint

Of 45 eyes that underwent a topography-guided ablation since June 2003, 22 required an additional retreatment to correct the residual refractive error or a residual corneal irregularity. Because of this high retreatment rate LASIK is preferable to surface ablations, he said.

Dr Vryghem noted that the predictability of the results of these topography-guided treatments should be improved. Clues for a better predictability are to take account of the astigmatic values as suggested by the topography and the T-CAT software, to take account of the spherical equivalent as suggested by the clinical refraction and to match the suggested ablation profile with the initial topography. In case of doubt the option that consumes less tissue is chosen.

Nevertheless, he noted that safety and efficacy were very satisfactory. "Some patients gained up to five lines of Snellen visual acuity, and even if some patients lost lines there was still a very high level of patient satisfaction," he said.

Of 42 responses received to a questionnaire, 80% of patients said their problems with halos were better, much better or perfect postoperatively, 90% considered their symptoms of glare also improved after treatment and almost 75% of patients said they were satisfied with their night vision after treatment with the Allegretto.

Wavefront-optimised versus wavefront-guided

The Allegretto Wave also measured up very well in terms of efficacy and safety in head-to-head trials with the wavefront-guided LadarVision CustomCornea (Alcon) platform, reported Stephen F Brint MD, Metairie, Louisiana, US.

Jérôme C. Vryghem

"There were small differences between the two systems primarily in the amount of induced HOA; both of them provided very good safety and efficacy and patient satisfaction was also very high for both sets of patients," he said.

In Dr Brint's study, patients were randomised to either bilateral treatment with CustomCornea or the Allegretto Wave with a 6.5 mm treatment zone for both groups, and a blend zone up to 9.0 mm for the CustomCornea treatments and up to 7.2 mm for the Allegretto wavefront-optimised systems.

Explaining the differences between the systems, Dr Brint said that the CustomCornea platform has the capability of registering the wavefront to the actual ablation, something that is not possible with the standard Allegretto Wave system.

"The Allegretto Wave treatment is designed to correct the lower order aberrations as well as spherical aberration based on a population average. That is essentially what the wavefront-optimised system does - it attempts to minimise spherical aberration induced by the excimer laser," he said.

In this context, "wavefront-optimised" denotes that the Allegretto Wave is a standard LASIK treatment, albeit one optimised to avoid the wavefront error of spherical aberration by maintaining the natural aspheric shape of the cornea. It is not the same as "wavefront-guided" treatments that attempt to correct pre-existing higher order aberrations, pointed out Dr Brint.

"The CustomCornea treatment is a true wavefront-guided treatment in which we correct not only lower order aberrations but also third, fourth, fifth and sixth order aberrations as well," he said.

Matthias J. Maus

Patients averaged about –3.0 D of myopia in the CustomCornea group and –3.5 D in the Allegretto Wave group with similar amounts of low astigmatism. Predictability was very good for both groups, reported Dr Brint, with 90% of the CustomCornea patients coming within 0.5 D of intended refraction at six months compared to 85% for the Allegretto Wave.

Uncorrected visual acuity at one month was also good for both groups: 73% of patients were 20/16 or better and 85% were 20/20 or better in the Allegretto Wave group compared to 70% and 83% respectively for the CustomCornea patients. Best-corrected visual acuity and photopic and mesopic contrast sensitivity were shown to be similarly improved for both groups postoperatively.

Dr Brint noted, however, that there was a statistically significant difference between the two platforms in terms of the total postoperative higher order aberrations.

"The total higher order aberrations showed a statistically significant increase in the Allegretto Wave group, manifested primarily by an increase in coma and also some trefoil, compared to no real change in the CustomCornea group," said Dr Brint.

He added that the increase in aberrations for the Allegretto Wave group did not include any increase for spherical aberrations, which had been effectively treated by the wavefront-optimised software.

"The CustomCornea system did produce lower postoperative higher order aberrations, primarily coma and trefoil, and this is because we are actually measuring and correcting the true wavefront as opposed to using the population average of wavefront-optimised data in the Allegretto Wave. The Allegretto Wave did, however, seem to maintain the low preoperative spherical aberration," he said.

Minimal spherical aberration induced in virgin eyes

In a separate presentation, Matthias Maus MD agreed that the wavefront-optimized ablation of the Allegretto Wave in myopic LASIK treatments typically showed zero or minimal induction of spherical aberrations.

"We know that spherical aberrations, especially induced ones, may severely impair night vision capability. In my experience with other laser platforms with non-wavefront-optimized profiles, the Allegretto Wave creates a significantly lower induction of spherical aberration and a minor increase in RMS values," he said.

Dr Maus reported on a series of 50 eyes of 25 myopic patients in which both eyes were treated wavefront-optimized with the Allegretto Wave. Follow-up examinations by an independent clinician took place at one day, one week, and one, three and six months after surgery.

After one month, the average uncorrected and best-corrected visual acuity was 20/20. Average preoperative spherical equivalent was -4.5 D compared to +0.15 D postoperatively. No eyes lost BCVA and a significant amount of patients gained at least one or more lines. The subjective perception of quality of night vision improved in 20% of patients at one month. RMS values showed a minor average increase postoperatively from baseline. Spherical aberration was reduced in 30% of the treated eyes at a 6.5 mm optical zone, reported Dr Maus.

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