Iris registration technology enhances surgical outcomes

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Accurate registration of the treatment to the eye is a fundamental determinant of outcomes of wavefront-guided laser vision correction surgery. On top of existing eye-tracking systems, laser manufacturers have added automated registration technologies able to compensate for the cyclorsional movement and pupil centroid shift that occurs between the wavefront assessment and laser treatment in order to assure precise alignment of the wavefront map and laser ablation in all axes.

David Chaokai Chang MD PhD, Taiwan Nobel Eye Institute, Taiwan, and Osama Ibrahim MD, Roayah Vision Correction Centres, Egypt, reported results from their analyses comparing outcomes of CustomVue wavefront-guided LASIK with and without the iris registration (IR) technology.

“Cyclorsional compensation is important because human eyes undergo not only XYZ movement but also torsional movement about their axes when the patient shifts from a seated to a supine position. Previous research shows the amount of cyclorsional movement typically ranges from 1 to 8 degrees and that lack of cyclorsional registration can induce errors,” said Dr Chang.

Iris registration provides a solution for cyclorsional compensation. However, a registration system must also take into account pupil centroid shift that occurs between the wavefront measurement and the laser treatment. The centre of the pupil is a moving target and its relationship to the outer iris boundary can change under different lighting conditions. When treating for spherical aberration, failure to compensate for pupil centroid shift can create coma, he noted.

Dr Chang described a group of 273 general cases, of which 152 were operated on with IR and 121 without. A second analysis considered a subgroup of patients with high astigmatism preoperatively, -1.5 D or more, of which 83 were treated with IR and 65 without. A third report was based on a study with a contralateral eye control including 26 patients undergoing CustomVue LASIK with IR in one eye and without IR in the fellow eye.

Dr Chang reported that results in all three studies showed the eyes treated with IR had significantly better UCVA outcomes than those treated without IR. In addition, in the study of eyes with high astigmatism, the eyes treated with IR had 50 per cent less residual postoperative cylinder than the non-IR group. Mean RMS values for total higher order aberration, secondary astigmatism, and third-order coma were all lower in eyes that underwent IR-enabled treatment versus those treated without IR, although the differences between groups were not statistically significant. “Iris registration is essential, but surgeons must still monitor eye movement during laser firing and re-register if necessary,” he said.

Osama Ibrahim MD, Alexandria University, Egypt, reported on the value of IR for achieving better quality of vision when performing wavefront-guided LASIK using the VISX Star S4 excimer laser.

“Wavefront-guided treatment has been proven to improve outcomes compared with conventional ablation, but the addition of IR adds two main advantages as it compensates for cyclorsion and for pupil centroid shift, both of which occur when the patient changes position from the wavefront aberrometry to the laser,” Dr Ibrahim said.

He conducted a prospective trial including 40 patients undergoing bilateral surgery with use of IR in one eye and the IR system deliberately turned off for the fellow eye surgery. The 80 eyes were comprised of 40 being treated for myopic astigmatism, eight eyes with mixed astigmatism, 26 eyes with hyperopia or hyperopic astigmatism, and six eyes undergoing presbyopic treatment.

Dr Ibrahim reported all eyes benefited with improvements in preoperative HOAs and contrast sensitivity. In addition, there were no differences between the IR-treated and non-IR eyes in the refractive or UCVA outcomes.

However, in subgroup analyses where eyes were categorised by type of treatment, there were significant differences showing better HOA outcomes and contrast sensitivity with IR use among eyes being treated for hyperopia, mixed astigmatism, or presbyopia.

“These results indicate that ignoring cyclorsion and pupil centroid shift may lead to suboptimal results and poorer quality of vision after wavefront-guided refractive surgery,” Dr Ibrahim said.

Eye tracking limbus vs. pupil-based

Paul van Saarloos PhD, presented data showing the accuracy of the limbal-based eye tracker of the Pulzar Z1 213-nm solid-state laser is about twofold greater than pupil-based technology.

“Performance of an eye tracking system has traditionally been judged based on speed. However,