PHARMACOLOGICAL pupil dilation is unnecessary for the majority of eyes undergoing wavefront evaluation using the Zywave aberrometer (Bausch & Lomb), suggests a new study presented at the XXIV Congress of the ESCRS.

Scott MacRae MD reported analyses from a trial including 508 eyes that underwent customised LASIK (445 eyes) or PRK (63 eyes) using the Zyoptix platform. One cohort of eyes in each treatment group was treated based on 2.5 per cent phenylephrine dilated wavefront information, while a second cohort was treated based on Zywave evaluation with a non-pharmacological pupil diameter of 6.3mm or larger.

The eyes were selected for customised ablation because they had more than 0.35 microns of pre-operative higher order aberrations (HOA). All eyes had ablations performed with a 6.3mm or larger optical zone using the University of Rochester nomogram that calculates sphere treatment based on pre-operative manifest refraction and HOA.

Refractive and visual outcomes at one month were excellent in both the LASIK and PRK groups. Overall, 94 per cent of eyes achieved UCVA of at least 20/20 and 95.5 per cent had an SE within 0.50 D of intended. Comparisons made within the LASIK and PRK subgroups showed there were no significant differences in the UCVA, SE, or predictability outcomes between the eyes that were pharmacologically dilated and those that were not.

"Wavefront evaluation with pharmacological pupil dilation has the advantage of providing more information for performing customised ablation. It allows treatment with a larger optical zone for better correction of higher order aberrations and better vision outcomes under mesopic conditions. However, one of the challenges is that the pupil centre shifts with dilation. That shift can affect the accuracy of the ablation, and it is a particular problem when pupil enlargement is pharmacologically induced as compared with caused by mesopic conditions," said Dr MacRae, professor of ophthalmology and visual science, University of Rochester, New York. "Our study demonstrated that eyes dilating naturally at the wavefront exam to 6.3mm or more achieved the same excellent outcomes as those undergoing the aberrometry assessment with pharmacological dilation. Now, new "No Di Zy" software is available that allows programming of an expanded treatment with a wavefront-driven optical zone 10 per cent larger than the maximum low mesopic pupil diameter obtained with the Zywave. With it, about 80 per cent of eyes can be treated with a 6.0mm optical zone by achieving a low mesopic pupil diameter of 5.5mm or greater," he added.

The software Dr MacRae referred to is known as the Zyoptix Advanced Personalized Treatment Software. It also incorporates the University of Rochester nomogram to calculate the treatment taking into account interactions between pre-operative coma, trefoil, and spherical aberration on postoperative sphere and adjusting the ablation to result in better predictability. Since it is based on optical "aberration interactions", the programme is not laser specific and could be generalised to other platforms.

Suitable for night driving

Dr MacRae believes the Zywave wavefront exam provides adequate pupil dilation to assess night driving conditions. The instrument’s Maltese cross fixation target has a luminance level equivalent to 0.05 candela/m2. Luminometer data collected by Dr MacRae showed drivers in rural areas on a moonless night are exposed to about 0.15 candela/m2 of light.

"Night driving is not a scotopic situation, and the luminance of this wavefront system is far below that of the low mesopic night driving conditions. We further decrease light exposure during testing by having patients drape a Gulden Black hood over their head. Under these conditions, about 60 per cent of patients in our study dilated to at least 6.3mm," Dr MacRae said.

The low light study included 293 pharmacologically dilated eyes in the LASIK group and 152 eyes with a non-pharmacological pupil diameter of 6.3mm or more. The former eyes were slightly less myopic than the non-pharmacologically dilated group. Mean pre-operative HOA was 0.53 microns in both groups.

After surgery, 94.5 per cent of eyes that underwent pharmacologic dilation achieved UCVA of 20/20 or better as did 94.74 per cent of eyes in the non-pharmacologic dilation group. Postoperative SE was -0.04 D in both groups, and 95.6 per cent of pharmacologically dilated eyes as well as 98.0 per cent of non-pharmacologically dilated eyes were corrected to within 0.5 D of the intended target. All eyes were within 1.0 D of intended correction.

"These results were very satisfying. Compared with the Zyoptix FDA study cohort, these eyes had higher average levels of myopia and HOA. Yet, their outcomes were much better than those achieved in the FDA trial, and that reflects the benefits of the University of Rochester nomogram," Dr MacRae said.

Dr MacRae also pointed out that the standard deviations for the mean SE outcomes were very low - 0.22 D for the pharmacologic dilation group and 0.17 D for the non-pharmacologic dilation group. "It is interesting to see how far we’ve come with outcome accuracy. The amount of standard deviation for the SE results is essentially less than what is seen in terms of the standard deviation of repeat manifest refraction systems," he said.

Within the PRK cohort, there were 42 eyes that had wavefront evaluation with pharmacologic dilation and 21 eyes that achieved pupil dilation of 6.3mm or more without pharmacologic dilation. Again, the pharmacologically dilated eyes were slightly less myopic than the non-pharmacologically dilated group and both PRK groups were more myopic (-6.60 to -6.80 D SE). Mean pre-operative HOA was the same in the PRK eyes compared with the LASIK group.

The postoperative results showed that 90.5 per cent of eyes in both the pharmacologic dilation and non-pharmacologic dilation PRK groups achieved UCVA of 20/20 or better. Mean postoperative SE was 0.08 D and 0.01 D, respectively. Again, all eyes were corrected to within 1.0 D of the target. Some 90.5 per cent of pharmacologically dilated eyes and 85.7 per cent of those in the non-pharmacologic dilation group achieved SE of 0.50 D of the intended target.

Cheryl Guttman
in London