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RESPONSE TO LETTER

Higher-Order Aberrations Following Ray Trace LASIK and the Impact of Eye Movement on Coma [Response to Letter]

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Dear editor

We thank the authors, Ning and Zhang,[1] for their comments and interest in our paper. We have attempted to address these in detail below.

1. Ning and Zhang propose that the patient's accommodation is affected by refractive surgery. They additionally suggest that accommodation can affect ocular aberration and, therefore, corneal aberrometry should be the metric of visual outcome. We would like to point out a few issues in this assessment. First, patients have their manifest refraction, wavefront refraction and the cycloplegic refraction assessed. These need to be within 0.5D of each other in order for the automatically generated ray trace LASIK treatment to be planned and applied. This ensures that accommodation is not affected, and a hyperopic outcome is avoided. Second, ray trace LASIK is based on ocular higher-order aberration, axial length, tomography and anterior chamber depth.[2] This is different to topography guided LASIK treatments which are based on corneal aberration. Since ocular higher-order aberrations are measured and targeted in the treatment, the appropriate analysis is to compare ocular preoperative higher-order aberrations with ocular postoperative higher-order aberrations. Visual outcomes for a patient will be affected by ocular higher-order aberration and cannot be directly inferred by corneal aberration which can be compensated by internal aberration. Therefore, we believe that ocular whole eye aberration is the better metric of visual outcome and success of treatment in ray trace LASIK.
2. Ning and Zhang also raise the issue of epithelial healing response following LASIK. They note that changes of 4.44 ± 4.41 microns and 4.60 ± 3.74 microns in the central and paracentral region would influence the accuracy of thickness measurements.[3] We would like to draw their attention to the fact that thickness measurement of corneas and decentration analysis in this study were limited to patients with over 4D of treatment. Therefore, the ablation in the center had to be greater than 55 microns which is x10 more than the epithelial healing change that they quote. It is unlikely, therefore, that the deepest point of ablation would be significantly affected by epithelial healing. Second, ablation is centered on the corneal vertex. As a result, the analysis of decentration was measured from the corneal apex. Regardless of the method of measurement of decentration, ie, the reference point used, it was applied in the same manner to all eyes. Therefore, irrespective of the reference point used for decentration measurement, the results of correlation between decentration and coma would still exist.
3. The results of the multivariate analysis of eye movement and decentered ablation were presented within the text and not as a table. This was deemed to be satisfactory by the peer review process.
4. Ning and Zhang suggest using the absolute value of vertical and horizontal eye movement rather than the average that was employed in the study. The use of average x and y values provides directional information about eye position ie, superior/inferior and nasal/temporal. The use of absolute values would not have provided this information but rather only the absolute deviation from the ideal. If total movement was utilized, this would have biased the results in longer treatments.

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Further in-depth analysis of this concept requires information on the proprietary temporal energy distribution of the treatment. Eye movements at different stages may have different effects if the energy distribution is not temporally uniform.

We thank Ning and Zhang for their interest in our paper.

Disclosure

Bala is a consultant for Alcon and J&J. Eye movement data was provided through a research agreement undertaken with Alcon. The authors report no other conflicts of interest in this communication.

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