

## Comments on

# Induced Secondary Astigmatism and Horizontal Coma after LASIK for Mixed Astigmatism

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This manuscript has discussed interesting points regarding ablation profiles and induced aberrations. Although the size of samples is low, the constant findings in the majority of cases make the findings valid.

I think the bias in this study is that there were not control groups to compare the findings and validate the conclusions. Are the induced low and high order aberrations in this group of cases due to specific algorithm (bitoric as mentioned)? Or these may happen with other ablation profiles too. We looked at several case of ours in 2 groups, one group the same as this study, i.e. mixed astigmatism and other group of compound myopic astigmatism with cylinder in the range of this study. Interestingly there were similar findings between our cases and cases reviewed in this study, and more interesting finding was that the same pattern of induced aberrations happened in both compound and mixed group. Most eyes in both groups had induced horizontal coma, secondary astigmatism and increase in hyperopia and minus cylinder at exam diameter, so our conclusion is that induction of these aberrations is due to high cylinder correction per se and not the pattern of ablation. Since the ablation is concentrated on the peripheral horizontal cornea in all cases, astigmatism may be induced in this area. Although radial energy loss and lack of radial compensation may play a role, it is more commonly associated with spherical aberration.

Blurred vision, glare and hallos are common subjective complaints after refractive surgery, even if it was customized or other techniques, so, correlation of specific aberrations with visual symptoms has to be documented with more evidence, as well as the clinical value of secondary astigmatism that increases with increasing pupil diameter. The issues of angle Kappa and centration of ablation on the pupil center, corneal vertex or visual axis are so complex that need extensive evaluation.

Another issue in this study is that most cases had undercorrection of hyperopia or indeed induction of hyperopia (hypropic shift). This is due to coupling effect of cylinder, that occurs more frequently in APT algorithm. It can also be due to aberration interaction. In our experience the advanced nomogram in APT algorithm underestimates these effects and operator should add more hyperopia or subtract more myopic sphere when correcting these conditions, specially when the cylinder is very high and the amount of higher order aberration (HOA) is also high.