

Understanding Variable Biologic-Based Factors in Determining Laser Refractive Surgery Outcomes: A Response to the Moshirfar et al Paper [Letter]

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Dear editor

My congratulations to Moshirfar et al for a very interesting and relevant paper¹ on the influence of pre-operative parameters on keratometric change per diopter of attempted spherical equivalent in the modalities of LASIK, PRK, and SMILE. Although more work needs to be done in understanding how this data could be used to understand refractive surgery outcome errors, it is evident that there is a pattern present where certain types of cornea will react differently to laser procedures depending on pre-operative curvature, age, and type of procedure. We believe examining epithelial thickness data would add to this analysis, as some of the curvature changes may be due to epithelial thickness changes, and these changes are already recognized as playing a part in refractive outcomes, especially with the advent of commercially available OCT epithelial thickness mapping.

More important to the bigger picture is the need for widespread acceptance of reasons for errors in outcomes that cannot be understood by the fixed Gullstrand model which has been the basis for many refractive surgery laser systems. This idea that all sources of error are quantifiable and adjustable for by nomograms and technology has led to the common fallacy that a mythological 2% enhancement rate for laser vision correction can be achieved. Due to this fixed model mode of thinking, posterior ocular astigmatism, which cannot be directly measured, has been virtually universally accepted as a major source of error that can be accounted for by such software programs as Phorcodes and hardware systems such as ray tracing. This belief in posterior ocular astigmatism has also led to a school of thought that manifest refraction must be used with topographic guided ablation. In reality, this author's real-world clinical experience and data have demonstrated that significant posterior ocular astigmatism is actually present in less than 1% of eyes.²

This author wrote a paper in this journal published in 2020 that demonstrated that biomechanical changes can occur in certain thicker, softer corneas when a LASIK flap is made, leading to an incorrect outcome with topographic guided ablation.³ The author also published in this journal a paper in 2020 that demonstrated pre-operative epithelial compensation of higher order aberration was also a significant factor in post-operative outcome error. The biomechanical change cannot be accounted for, it can only be avoided by performing PRK instead. The epithelial compensation can be accounted for, but not with current and future procedures such as ray tracing that continue to see posterior ocular issues as the main source of error in laser refractive surgery outcomes.

This particular paper demonstrates the fallacy of using a fixed, Gullstrand model in attempting to solely understand the basis of errors in outcome after laser refractive procedures. Essentially, this paper also states that biological factors that are not easily controlled can lead to errors in outcomes in the best planned refractive surgery procedures. Although Moshirfar et al perform a very thorough analysis of the data, they are still unable to provide definitive answers on how these biological variables can be incorporated into a nomogram or a procedure to eliminate this source of error.

This author feels that the time has come for surgeons, researchers, and corporations to change how they pursue the creation of a better ocular focusing system. This requires acceptance of the presence of biological variables that cannot be

easily accounted for in laser refractive procedures, and of the understanding that visual outcomes for patients are not necessarily best achieved solely via mathematical calculations utilizing a fixed Gullstrand model.

Disclosure

The author reports no conflicts of interest in this communication.

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