Refractive viewpoints place focus on true 'visual axis'

David R. Shapiro, MD

This extremely important issue has previously not received the attention in LASIK that it deserves. I agree with Dr. Boxer Wachler's preference for centering on "visual axis" rather than over the pupil. More properly, this should be conceptualized as centration on the first Purkinje image rather than over the entrance pupil, as there is debate as to where the true "visual axis" is.

Centration over the first Purkinje image is centered on the reflex of a centration light under a co-axial microscope, whereas the centration over the entrance pupil is centration over the virtual pupil as imaged through the cornea. The debate as to which is the "true" visual axis and therefore about where to center refractive surgery properly **actually goes back to the era of RK.**

Because of the use of very small optical zones, RK results provided another important "laboratory" for assessing optimal centration. In the Casebeer system of RK, central clear zones of 2.75 mm were routinely used and the advanced Casebeer courses taught technique using central clear zones down to 2.25 mm.

Obviously with clear zones this small, centration over the true visual axis became critical: of the surgery were even slightly decentered, the patient could be looking through the RK incisions. Dr. Casebeer always taught that the surgeon should use the first Purkinje image as the point of centration. In many patients, this is very different from the center of the entrance pupil.

Dr. Casebeer cited good optical results and highly centered corneal topography in the small clear zone cases as functional proof the first Purkinje image had to be the correct place to center keratore-fractive surgery. For him, this trumped the theoretical arguments, noted by Dr. Boxer Wachler, the Drs. Uozato and Guyton were making on one hand and that Drs. Pande **and Hillman were making on the other hand.**

This argument has largely been forgotten as refractive surgery entered the PRK and LASIK eras. Both VISX and Alcon's LADARVision—the two most commonly used laser systems in the United States— have taught to center treatments over the entrance pupil and this has now become conventional thinking, even though centration **over the entrance pupil will necessarily create decentration with respect to the first Purkinje image (in those very common patients in which the first Purkinje image is not in the center of the entrance pupil).**

With myopic treatments, this has probably been an acceptable error since minor decentrations tend not to affect the results of **modern myopic ablations with optical zones of 6 mm or more. This may, however, explain why a perfectly performed ablation may show decentration on corneal topography.**

Because hyperopic ablations have smaller optical zones, and because patients with hyperopia tend to have a more decentered first Purkinje images in relation to the **entrance pupil (larger able kappa), centration is much more critical than in myopic cases. Dr. Boxer Wachler's excellent paper suggests superior results by centering hyperopic LASIK where all keratorefrative surgery really should be centered: over the first Purkinje image.**

I personally center both conventional myopic and hyperopic treatments over the **first Purkinje image. The VISX system allows for manual locking of the eye tracker (manual centration) to achieve this effect. The LADARVision system allows for** manipulation of the papillary rings to achieve this effect also. Both systems, however, rely on surgeon estimation of centration over the first Purkinje image.

It is important to note that customized wavefront ablations follow a different logic **as the actual wavefront reading is referenced to the center of the pupil and the treatment is also referenced to the center of the pupil.**

Shapiro DR: LASIK Centration: Refractive Viewpoints Place Focus on Ture "Visual Axis" (letter) Ophthalmology Times, April 1, 2000, 29 (7), p. 4.

David Shapiro, M.D.
Shapiro Laser Eye Center
Ventura, Santa Barbara, and San Luis Obispo